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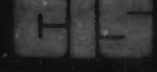

S. HRG. 101-342

LOUISIANA COASTAL WETLANDS

HEARING

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED FIRST CONGRESS

FIRST SESSION

ON

AMENDMENT NO. 229 TO S. 406

BATON ROUGE, LA, AUGUST 31, 1989

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Committee on Energy and Natural Resources

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LOUISIANA COASTAL WETLANDS

THURSDAY, AUGUST 31, 1989

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Baton Rouge, LA.

The committee met, pursuant to notice, at 9:03 a.m., in the Senate Committee Hearing Room A, State Capitol Building, Baton Rouge, LA.

OPENING STATEMENT OF HON. J. BENNETT JOHNSTON, U.S. SENATOR FROM LOUISIANA

The CHAIRMAN. The hearing will come to order. Good morning to all of you. As a former member of the Louisiana State Senate, I am glad to see that the facilities here have improved markedly, along with the quality of the membership since I was here.

Louisiana is greatly blessed with having more wetlands, and more forested or upland wetlands, and more coastal wetlands than any other state. We are cursed in that we are losing more wetlands than any other state. We have done a reasonably good job with respect to our forested wetlands. Louisiana, in fact, has received from the Appropriations Committee more money and has set aside more acreage than any state or any combination of states, or indeed more than all the other states combined in the last few years in terms of forested wetlands, or upland wetlands, or bottomland hardwood lands as we call them. We have spent over $120 million in the Appropriations Committee on these forested wetlands. They include, of course, our Jean Lafitte National Park on which we have spent $17 million to acquire 9,000 acres of prime wetlands; Bogue Chitto National Wildlife Refuge created by Congressional Act and funded by some $18 million to acquire over 26,000 acres; the Tensas National Wildlife Refuge on which we have set aside some $56 million in Federal funds in order to acquire almost 55,000 acres in northern Louisiana; the Atchafalaya National Wildlife Refuge on which we have spent over $16 million to acquire some 15,000 acres in that very rich area of Louisiana, and much more is to be applied to the Atchafalaya.

Our newest wildlife refuge is the Lake Ophilia in Grand Colt National Wildlife Refuge on which in just this year's bill we have set aside some 6,685 acres. Bayou Savage in New Orleans, New Orleans East, will be, we hope, we think, a very great wetlands resource, and we have appropriated $8 million for that. We are going to purchase some 18,000 acres in that area. This year's bill, the Loggy Bayou Refuge, we will set aside 5,000 acres at a cost of $2.5 million. So in terms of forested wetlands, a very great problem be-

cause we have lost some 37 percent of our forested wetlands since 1937, we have done a good job. There is more to do and we will rise to that challenge.

The biggest problem, however, in Louisiana has to do with coastal wetlands. It has been estimated at one time that we are losing as much as 40 square miles a year. When we say we are losing, we mean, of course, the State of Louisiana and its citizens, who pay such great stock in our wetlands because it is our recreation area, where we fish, where we hunt. It is the source of our seafood, which in turn is endemic of a very strong part of our way of life in Louisiana, but it is more than a Louisiana loss. It is a national loss because the 1.9 billion pounds of seafood which are produced off our shore and for which we are the spawning area are consumed from coast to coast, from north to south, famous the world over. It is indeed a national resource as our deferred resources, as are the bird life resources of these wetlands area. So from a national standpoint, we cannot afford to lose our wetlands. The question is what do we do about it?

If there is one comment I hear more than any other as I travel around the state, it is that it is time to quit studying and start doing something. While it is surely not time to quit studying, it is time to begin to do more, but to do more takes very serious money, takes very serious resources from both the State and the Federal government. In terms of studies, I think it is important to point out that we are indeed studying the problem on a continuing basis. We have one series of studies that will take six years to complete (we are now in our fourth year) that will cost a total of $17 million in Federal funds. It includes studying the kind of plant life that will generate and hold our marsh areas. The ecology of the marsh has changed. As inevitable saltwater intrusion and other not so inevitable saltwater intrusion has occurred, the salinity levels of the marsh have changed, which means that new kinds of plant life may be introduced which can save the marsh. And so it is that the United States Geological Survey, along with the Fish and Wildlife Department, are studying these kinds of flora that can perhaps hold the marsh together. In addition to that, of course, we are studying barrier islands, we are studying the kinds of controls that can be put in the marsh. A total of $17 million over a period of six years.

The University of Southern Louisiana has been designated as the National Wetlands Center. We have appropriated some $8 million to build the building there at U.S.L. and they will conduct at U.S.L. many of these studies along with scholars from Louisiana State University and from the Fish and Wildlife Service and the U.S.G.S.

In terms of actual construction, there are two projects, or actually more than two projects, but we have grouped them together as two projects.

The first is the Louisiana Mississippi Estuarine Project or the Bonnet Carre Project. It is a project costing some $69 million designed to divert water from the Mississippi River and the Bonnet Carre area through the marshes in the area surrounding Lake Pontchartrain. These are some of our richest marshes, and they are great producers of oysters. In the case of Lake Pontchartrain

which is very sensitive to the amount of salinity, this project is in its final planning stages now and is being funded every year by the Congress.

The second project, or really group of projects, is the Mississippi Delta Salinity Control Project which involves four structures. The Bohemia and Caernarvon structures located on the east bank of the Mississippi River, the Bohemia Project down in Plaquemines Parish where Mr. Petrovich reigns; the Caernarvon Project which is below New Orleans in the Grand Lake area. They are designed to take freshwater and silt from the Mississippi River and divert it into these marsh rich areas.

The second control structures are on the west bank, in the Davis Pond area in St. Charles Parish above New Orleans and in the home place area below New Orleans in the Plaquemines area. These projects will cost a total of some $77.2 million and we are just beginning. So you can see that between these two projects you are talking about almost $140 million and we are talking about, to be sure, very valuable wetland resources, but nevertheless, a small percentage of the 40 square miles of wetlands that we are losing. So the scope of this project is tremendous. It is much bigger than most people think about.

We are soon to be voting on a constitutional amendment here in Louisiana which sets aside tax revenues for wetlands preservation. I understand that some $5 million a year in State funds will be set aside for this purpose. You can imagine if these projects, which are only a very small part of the problem, total some $140 million and the State is only setting aside some $5 million, you can imagine how small the action of the State is compared to what needs to be done. It is only a small fraction of what needs to be done. In my view the problem involves hundreds of millions of dollars, hundreds of millions of dollars every year for many years and then we still can't stop all of the coastal, we call it coastal erosion. Of course it is more than erosion, it is subsidence, it is pollution, it is all of those things that result in wetlands loss. Nevertheless the scope of the problem, while it is big, while it is huge, the value of the resource is very great and we must, not only as a state, but as a nation, respond.

I have introduced legislation which sets up a mechanism that directs the Secretary of the Interior in consultation with other effected agencies—EPA, the Department of the Army through the Corps of Engineers and others—to prepare a list of high priority projects to protect, enhance, restore and create coastal wetlands. At the hearing we had on this measure in Washington, D.C. earlier this summer, it was suggested that representatives from the effected coastal states be included in the list for the preparation process. That is an excellent idea and we will incorporate that idea into our legislation. The money to pay for the projects on this list will come from the special account which we create that is funded by a fee of 2 cents per thousand cubic feet on natural gas produced in the outer continental shelf. Under current production and pricing assumptions, this would produce approximately $85 million to $100 million per year. The bill would also authorize the expenditure of up to $10 million annually to do studies and preliminary engineering in order to identify these projects.

Now again, the studies in this respect are more than just paper studies. They are an identification of the projects using the benefit-cost ratio mechanism that the Corps of Engineers employs. In doing the actual preliminary design, so that we can put a reasonably hard cost figure on the various projects, it should be noted that in this legislation we have created a mechanism whereby the money is spent automatically for projects on the list in the order that they appear on the list. Unless the list is specifically modified by an act of Congress, this money will be made available every year for wetlands projects. It is also important to point out that this legislation creates a new dedicated funding source for coastal wetlands projects. It is not simply new budget authority, which really means that you have the authority to try and take the money from other projects, but it is a dedication.

This is the central point of my legislation. That is, an authorization frankly means very little in the Congress. It means that you can go and try to take money from drugs or from national defense or from childrens' programs or from education and the answer always is that no you can't take the money from these other projects. That is why we need a new source of revenue dedicated and sufficient to deal with the problem of wetlands. That is the key to this legislation.

Finally, the legislation includes a preference for projects in states where oil and gas is produced offshore in the outer continental shelf. Clearly such a preference will result in much, frankly most of the money, being spent in Louisiana. Some have asked "Well, will the Congress go along with such a preference for Louisiana?" My answer is that the problem is principally a problem that occurs in Louisiana. It is a national problem, but it is one that happens to occur in our State because most of the wetlands lost is in this State. For that reason I think the earmarking of the money for Louisiana does have an excellent chance of passing mustard before the Congress. In my judgment, we must do something, we must do something big, and we must begin soon in order to stem this tide.

We have a distinguished group of witnesses this morning to testify about this problem and I hope we will be able to focus particularly on the mechanism. There is no one in this room, I am quite sure, who has to be convinced that Louisiana wetlands are valuable, that they are worth preserving, that we should do something about it. So we are not here to convince one another that Louisiana wetlands are important, but we are here, and what I would invite you to focus in on this morning is the mechanism by which we can solve this problem and to try to define that problem and to design legislative responses to it. My legislation is my idea of what we ought to do. It is not the only approach. Indeed I am a coauthor of other bills. We are going to attack this problem from any number of different directions and if we do not succeed in one piece of legislation, we will try in other pieces of legislation. This, however, in my judgment, is the best approach that we should pursue.

[The prepared statement of Senator Johnston and amendment No. 229 to S. 406 follow:]

STATEMENT OF SENATOR J. BENNETT JOHNSTON

The purpose of today's hearing is to receive testimony on legislation I have introduced which would impose a fee of two cents per thousand cubic feet of natural gas produced from the Outer Continental Shelf and deposit this money in a special account to be used to fund high priority projects to protect, restore, enhance or create coastal wetlands.

This legislation is based on three factors:

First, the erosion of coastal wetlands and marshes is a serious national problem that has reached crisis proportions in Louisiana;

Secondly, there are actions that can be taken, and things that can be accomplished, in the near term to help alleviate this problem; and

Thirdly, the key to accomplishing anything of lasting significance in this area is to establish a new and dependable federal funding source dedicated to helping to solve this problem.

As I have already indicated to the witnesses appearing here today, this hearing will focus on the last two points. We all know that there is a serious problem with coastal wetland loss in our state.

We have all heard, and are all familiar with, the numbers, statistics and projections related to wetland loss in the nation and Louisiana in particular. We do not need to repeat or dwell on these numbers at this hearing. We are all acutely aware of the problem or we wouldn't be here.

What I hope we can do today is to discuss and identify specific and realistic projects, activities, and actions that we can undertake now to help solve this problem, and, at the same time, find ways to pay for them.

My bill sets up a mechanism that directs the Secretary of the Interior, in consultation with other affected agencies, to prepare a list of high priority projects to protect, enhance, restore, or create coastal wetlands. At the hearing we had on this measure in Washington, D.C. earlier this summer, it was suggested that representatives from the affected coastal states be included in the list preparation process. I think that is an excellent suggestion and will offer an amendment to make that addition at the appropriate time.

The money to pay for projects on this list will come from a special account which we create that is funded by a fee of two cents per thousand cubic feet of natural gas produced from the ocs. Under current production and pricing assumptions, this would amount to approximately $85-100 million annually for the types of projects. The bill also authorizes the expenditure of up to $10 million annually from the fund to do any studies or other preliminary work necessary to

identify projects for inclusion on the list.

It should be noted that under this legislation, we have created a mechanism whereby the money is spent automatically for projects on the list, in the order they appear on the list. Unless the list is specifically modified by an act of Congress, this money will be made available every year for wetlands projects. It is also important to point out that this legislation creates a new dedicated funding source for coastal wetlands projects. It is not simply new budget authority which really means that you have the authority to try and take money from existing programs! This is real money which will be used to achieve tangible results.

Finally, the legislation includes a preference for projects in states where oil and gas is produced offshore in the OCS. Clearly, such a preference will result in much of this money being spent in Louisiana. Given the severity of the problem in coastal Louisiana, and the extent of oil and gas activities off our coast, I feel that such a preference is clearly warranted.

I look forward to the testimony today. I urge all witnesses to summarize, not read, your statements so that there will be time for some questions.

AMENDMENT NO. 229 Calendar No. 28

Purpose: .....

.....

.....

IN THE SENATE OF THE UNITED STATES 101st Cong., 1st Sess.

S. 406

To authorize competitive oil and gas leasing and development on the Coastal Plain of the Arctic National Wildlife Refuge in a manner consistent with protection of the environment, and for other purposes.

June 23 (legislative day, January 3), 1989

Referred to the Committee on Energy and Natural Resources and ordered to be printed

AMENDMENTS intended to be proposed by Mr. JOHNSTON (for himself and Mr. BREAUX)

Viz: Amend S. 406, the "Arctic Coastal Plain Competitive Oil and Gas Leasing Act", by striking all after the enacting clause and substituting therefor the following new language:

SECTION 1. SHORT TITLE.—This Act may be cited as the "Gulf of Mexico Oilspill Prevention and Response Act".

SEC. 2. DEFINITIONS.—As used in this Act, the term—

(a) "Gulf of Mexico and lower Mississippi River" means (1) all waters seaward from the coastline east of 98 degrees west longitude and west of 80 degrees 30

minutes west longitude, extending to the seaward boundary of the exclusive economic zone as established under Presidential Proclamation Numbered 5030, dated March 10, 1983; (2) that portion of the Mississippi River running adjacent to or within the boundaries of the State of Louisiana including its navigable tributaries located adjacent to or within the State of Louisiana; and (3) the Gulf Intracoastal Waterway: *Provided*, That the Secretary is directed to publish within one month of the date of enactment of this Act regulations defining the precise boundaries of the area covered by this Act;

(b) "oil" means petroleum, including crude oil or any fraction or residue therefrom;

(c) "public vessel" means a vessel which—

(i) is owned or chartered by demise, and operated by (A) the United States, (B) a State or political subdivision thereof, or (C) a foreign government; and

(ii) is not engaged in commercial service;

(d) "Secretary" means the Secretary of the Department in which the Coast Guard is operating;

(e) "spill" means any emission (other than natural seepage), intentional or unintentional, and includes, but

is not limited to, spilling, leaking, pumping, pouring, emitting, emptying, or dumping;

(f) "tanker" means a vessel constructed or adapted primarily for the carriage of oil in bulk or in commercial quantities as cargo; and

(g) "vessel" means every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water other than a public vessel.

TITLE I—AMENDMENTS TO THE OUTER CONTINENTAL SHELF LANDS ACT

SEC. 101. OFFSHORE OIL POLLUTION COMPENSATION FUND.—

(a) INCREASE IN FUND AND ESTABLISHMENT OF ACCOUNTS.—Section 302(a) of the Outer Continental Shelf Lands Act Amendments of 1978 (43 U.S.C. 1812(a)) is amended by deleting the subsection in its entirety and inserting in lieu thereof the following:

"(a)(1) There is hereby established in the Treasury of the United States an Offshore Oil Pollution Compensation Fund (the "Fund"). The Fund shall contain an Oil Pollution Account and a Wetlands Protection, Restoration, and Enhancement Account (the "Wetlands Account"). Except as otherwise provided in this subsection, moneys collected pursuant to subsection (d) of this section as a result of the fee

imposed on oil obtained from the Outer Continental Shelf shall be deposited into the Oil Pollution Account. Moneys collected pursuant to subsection (d) of this section as a result of the fee imposed on gas obtained from the Outer Continental Shelf shall be deposited into the Wetlands Account.

"(2) The Secretary of the Treasury shall continuously monitor the amount of moneys deposited into the Fund. When the Oil Pollution Account reaches $500,000,000 all additional moneys collected pursuant to subsection (d) of this section as a result of the fee imposed on oil obtained from the Outer Continental Shelf shall be deposited into the Wetlands Account.

"(3) Notwithstanding the previous paragraph, if at any time the Oil Pollution Account falls below $500,000,000, all moneys collected pursuant to subsection (d) as a result of the fee imposed on oil produced from the Outer Continental Shelf shall be deposited into the Oil Pollution Account until such account reaches $500,000,000.

"(4) The Oil Pollution Account shall be maintained at a level of not less than $500,000,000, and not more than $550,000,000 except that such amount shall be increased to the extent necessary to permit any moneys recovered or collected which are referred to in subsection (b)(2) of this section to be paid into the Fund.

"(5) The Oil Pollution Account within the Fund shall be administered by the Secretary and the Secretary of the Treasury as specified in this Act. The Wetlands Account within the Fund shall by administered by the Secretary of the Interior and the Secretary of the Treasury as specified in this Act.

"(6) The Oil Pollution Account within the Fund may sue and be sued in its own name.".

(b) WETLANDS ACCOUNT.—Section 302 of the Outer Continental Shelf Lands Act Amendments of 1978 (43 U.S.C. 1812) is amended by adding a new subsection (d) as follows and redesignating the remaining subsections (d) through (f) as subsections (e) through (g):

"(d)(1) Funds deposited in the Wetlands Account shall remain available until expended and may be used solely in accordance with the provisions of this section.

"(2)(A) As soon as practicable after the date of enactment of the Gulf of Mexico Oilspill Prevention and Response Act, the Secretary of the Interior, in conjunction and consultation with the Secretary of the Army acting through the Chief of the Corps of Engineers, the Secretary of Commerce, the Secretary of Agriculture, and the Administrator of the Environmental Protection Agency shall initiate a process to identify and prepare a list of high priority projects to pre-

serve, protect, enhance, restore, or create coastal wetlands in the United States.

"(B) To assist in the preparation of the list, the Secretary of the Treasury shall make funds available from the Wetlands Account to the Secretary of the Interior to prepare preliminary assessments; general or site specific inventories; reconnaissance, engineering, or other studies; preliminary design work; and such other studies as may be necessary to identify such projects.

"(C) Such funds as are necessary for these purposes, but not to exceed $10,00,000 annually, shall be allocated by the Secretary of the Interior to the Federal agencies identified in paragraph (2)(A) (including the Department of the Interior) based on the need for such funds and such other factors as the Secretary of the Interior, in consultation with the other agencies, deems appropriate to carry out the purposes of this subsection.

"(3)(A) As soon as practicable after funds are made available pursuant to paragraph (2), the Secretary of the Interior shall compile and transmit the list of priority projects to the Congress. Thereafter, the list shall be transmitted to the Congress annually as part of the President's budget submission. Such transmittal shall also include a statement from the Secretary of the Treasury indicating the amount available for expenditure from the Wetlands Account.

"(B) The list shall include, but not be limited to, the following:

"(i) identification, by map or other means, of the coastal wetland area to be covered by the project; and

"(ii) a detailed description of the proposed project including a justification for including such project on the list, the proposed activities to be carried out pursuant to the project, the benefits to be realized by such project, the identification of a lead agency to undertake the proposed project, an estimated timetable for the completion of project, and the estimated cost of the project.

"(C) Where such a determination is required under applicable law, benefits of projects on the list are deemed to be at least equal to the costs associated with such projects.

"(D) In preparing the list, special consideration shall be given to the inclusion of projects affecting coastal wetland areas having particularly high value as fish and wildlife habitat, for purposes of flood or pollution control and which are, or are likely to be, subject to erosion, conversion or other degradation.

"(4) Except as provided in paragraph (2), funds from the Wetlands Account shall be allocated in accordance with the list submitted pursuant to this section unless such list is modified by law: *Provided*, That funds in the Wetlands Ac-

count shall be available for projects within a State in proportion to the amount of production of oil and gas on the Outer Continental Shelf seaward from the submerged lands of such State.

"(5) Unless the list is modified by law, the Secretary of the Treasury is authorized and directed, beginning one year after the list is transmitted pursuant to paragraph (3)(A), to make funds from the Wetlands Account directly available to the head of the appropriate agency for the purpose of carrying out projects as identified on the list and in accordance with paragraph (4). If the list is modified by law, the Secretary shall take action in accordance with such modifications.

"(6) As used in this subsection, the term "project" means a complete project or, where applicable, individual phases, portions, or components thereof.".

(c) FEES.—Section 302(d)(1) of the Outer Continental Shelf Lands Act Amendments of 1978 (43 U.S.C. 1812(d)(1)) is amended by striking "not to exceed 3 cents" and inserting "10 cents" and adding at the end thereof: "The Secretary of the Interior shall levy and the Secretary of the Treasury shall collect a fee of 2 cents per thousand cubic feet of gas obtained from the Outer Continental Shelf, which shall be imposed on the owner of the gas when the gas is produced.".

(d) CONFORMING AMENDMENTS.—

(1) Section 302(c) of the Outer Continental Shelf Lands Act Amendments of 1978 (43 U.S.C. 1812(c)) is amended by striking the word "Fund" in the first and second sentences and inserting in lieu thereof "Oil Pollution Account of the Fund" in each sentence and by striking paragraph (3) and inserting in lieu thereof:

"(3) subject to such amounts as are provided in appropriation Acts, all administrative and personnel costs of the Federal Government incident to the administration of the Oil Pollution Account of the Fund, including, but not limited to, the claims settlement activities and adjudicatory and judicial proceedings, whether or not such costs are recoverable under section 308 of this Act.".

(2) Section 302(d)(2) of the Outer Continental Shelf Lands Act Amendments of 1978 (43 U.S.C. 1812(d)(2)) is amended by deleting paragraph (2) in its entirety and inserting in lieu thereof the following:

"(2) The Secretary of the Treasury, after consulting with the Secretary and the Secretary of the Interior, shall promulgate reasonable regulations relating to the collection of the fees authorized by paragraph (1) of this subsection. No

regulation that sets fees, whether or not in effect, may be stayed by any court pending completion of judicial review of such regulation.".

(3) Section 302(e)(1) of the Outer Continental Shelf Lands Act Amendments of 1978 (43 U.S.C. 1812(e)(1)) is amended by deleting "Fund" and inserting in lieu thereof "each account within the Fund".

(4) Section 302(e)(2) of the Outer Continental Shelf Lands Act Amendments of 1978 (43 U.S.C. 1812(e)(2)) is amended by deleting "the Fund" in the first sentence and inserting in lieu thereof "each account within the Fund" and by deleting the last sentence of the paragraph and inserting in lieu thereof the following: "The interest on, and the proceeds from the sale of, any obligation held in the Fund shall be deposited in and credited to the appropriate account within the Fund.".

(5) Section 302(f) of the Outer Continental Self Lands Act Amendments of 1978 (43 U.S.C. 1812(f)) is amended by deleting "Fund" at each place where it appears in the subsection and inserting in lieu thereof "Oil Pollution. Account of the Fund".

(6) Section 304(f)(1) of the Outer Continental Self Lands Act Amendments of 1978 (43 U.S.C. 1814(f)1)) is amended by deleting "Fund" and inserting in lieu thereof "Oil Pollution Account of the Fund".

(7) Section 306(c) of the Outer Continental Shelf Lands Act Amendments of 1978 (43 U.S.C. 1816(c)) is amended by deleting "Fund" and inserting in lieu thereof "Oil Pollution Account of the Fund".

(8) Sections 307, 308, and 312 of the Outer Continental Shelf Lands Act Amendments of 1978 (43 U.S.C. 1817, 1818, and 1822) are amended by deleting "Fund" each place where it appears in those sections and inserting in lieu thereof "Oil Pollution Account of the Fund."

(9) Section 309(b) of the Outer Continental Shelf Lands Act Amendments of 1978 (43 U.S.C. 1819b)) is amended by inserting "and the Oil Pollution Account within the Fund" after "Fund".

SEC. 102. OILSPILL RESEARCH AND DEVELOPMENT CENTER.—Section 302 of the Outer Continental Shelf Lands Act Amendments of 1978 (43 U.S.C. 1812) is amended by adding the following new subsection:

"(g)(1) The Secretary of the Department in which the Coast Guard is operating shall establish a Research and Development Center (hereinafter referred to as the 'Center') to be administered by the Commandant of the Coast Guard.

"(2) The Center shall conduct and support, through contracts and grants, research, development, testing, and training in the best available techniques, equipment, and materials to prevent, contain, remove, recover, and clean up oil spills by vessels transporting oil affecting the navigable waters of the United States and those waters extending seaward from the coastline of the United States to the seaward boundary of the exclusive economic zone as established under Presidential Proclamation Numbered 5030, dated March 10, 1983.

"(3) In administering the Center, the Secretary of the Department in which the Coast Guard is operating shall consult regularly with representatives of the Departments of Commerce, the Interior, the Environmental Protection Agency, the Navy, foreign governments, international organizations, and knowledgeable academic, industry, and other persons in order to identify and pursue development of the best available techniques, equipment, and materials.

"(4) There are authorized to be appropriated to the Secretary of the Department in which the Coast Guard is operating, for purposes of carrying out the provisions of this sec-

tion, $10,000,000 in each of the fiscal years ending September 30, 1990 through September 30, 1995.".

SEC. 103. OILSPILL CONTINGENCY PLANS.—Section 5 of the Outer Continental Shelf Lands Act (43 U.S.C. 1334) is amended by adding at the end thereof a new subsection (j) as follows:

"(j) The holder of any oil or gas lease issued or maintained under this Act shall submit an oil spill contingency plan for approval by the Secretary prior to engaging in any exploration, development or production activities on such lease.".

SEC. 104. INSPECTION OF OILSPILL PREVENTION AND CONTAINMENT EQUIPMENT FOR THE OUTER CONTINENTAL SHELF.—Section 22(c) of the Outer Continental Shelf Lands Act (43 U.S.C. 1348(c)) is amended by deleting the word "and" at the end of paragraph (1), replacing the period at the end of paragraph (2) with "; and" and adding a new paragraph (3) as follows:

"(3) an onsite inspection no less than two times each year without advanced notice to the operator of such facility of all equipment to prevent, ameliorate, or contain oil spillages, including equipment maintained by contractors.".

SEC. 105. DRILLS AND REQUIRED EQUIPMENT.—Section 22 of the Outer Continental Shelf Lands Act (43 U.S.C.

1348) is amended by redesignating subsections (d) through (g) as subsections (e) through (h) and inserting a new subsection (d) as follows:

"(d) The Secretary and the Secretary of the Department in which the Coast Guard is operating shall individually, or jointly if they so agree, promulgate regulations—

"(1) to provide for drills for familiarization with pollution control equipment and operational procedures when the equipment is placed initially and at least once every six months by the lessee or a contractor serving the lessee, with such drills simulating conditions in the area of operations and including deployment and operation of equipment; and

"(2) to require that equipment which the Secretary and the Secretary of the Department in which the Coast Guard is operating deem to be essential to carry out the oilspill contingency plan and to ensure the prompt containment of spilled oil be maintained at the site of operations.".

TITLE II—OILSPILL CONTINGENCY PLANNING

SEC. 201. APPLICABILITY.—This title applies to owners or operators of vessels transporting oil in the Gulf of Mexico or the lower Mississippi River and owners or operators of oil-producing, refining, or transportation facilities that, due to their location, reasonably could be expected to spill oil

into or upon the Gulf of Mexico or the lower Mississippi River or adjoining shorelines.

SEC. 202. OILSPILL CONTINGENCY PLANS.—Not later than one hundred and eighty days after the date of enactment of this Act, the Secretary shall issue a final rule requiring persons subject to this section to prepare and submit to the Secretary for approval an oilspill contingency plan for the prevention, containment, and cleanup of oilspills from vessels or facilities described in section 201. At a minimum, such plans must include—

(a) a clear and precise, detailed description of how the individual plan relates to and is integrated into the overall National Contingency Plan;

(b) an analysis of the "maximum probable spill" from the facility or vessel determined in accordance with the guidelines established under section 205 of this Act;

(c) procedures for early detection and timely notification regarding oilspills;

(d) a description of procedures to be used to minimize the damage from a spill and to make immediate repairs if possible;

(e) a description of countermeasures, response and cleanup personnel and equipment and their locations, and the time required to deploy them at the spill site;

(f) procedures to assess the severity of the oilspill, to plan countermeasures, and to begin cleanup efforts; and

(g) provisions for disposal of recovered spill material. Such plans shall not be required for any facility or vessel covered by an oilspill contingency plan required by the Outer Continental Shelf Lands Act. With respect to vessels, such plans shall be required to the maximum extent consistent with international law.

SEC. 203. COOPERATIVE EFFORTS.—In complying with this section, an owner or operator of a vessel or facility may rely on his or her participation in a cooperative effort with other persons subject to this title to develop satisfactory contingency plans.

SEC. 204. APPROVAL OF PLANS.—(a) In approving the contingency plans required by this title, the Secretary shall consider the adequacy of risk analysis in the determination of maximum probable spill, the estimated response time, and the adequacy of trained personnel and communications equipment, and equipment to prevent, ameliorate, and contain oil spillages.

(b) No plan shall be approved unless the Secretary determines that the equipment listed in the plan is sufficient to respond to the maximum probable spill from the vessel or facility in question.

SEC. 205. GUIDELINES FOR MAXIMUM PROBABLE SPILL.—The Secretary shall publish guidelines for the determination of maximum probable spill from a vessel or facility, taking into account the amount of oil being transported, stored, or transferred, weather and other natural conditions, technological capability, and the risk of a spill.

SEC. 206. PUBLIC AWARENESS AND PRACTICE DRILLS.—(a) The Secretary shall annually publish an up-to-date list of the contingency plans prepared for oilspills in the Gulf of Mexico and the lower Mississippi River and an inventory of equipment available for responding to such spills.

(b) The Secretary shall annually conduct practice drills of the contingency plans prepared for oilspills in the Gulf of Mexico and the lower Mississippi River pursuant to this title. The Secretary shall publish a report on such drills including an assessment of actual response time, available equipment as compared to equipment listed in the contingency plans, and requirements, if necessary, for changes in the plans.

SEC. 207. PREPARATION OF REPORT ON ADEQUACY OF OILSPILL CONTINGENCY PLANS.—(a) Within one hundred and eighty days of the date of enactment of this Act, the Secretary of Transportation, the Secretary of the Interior and the Administrator of the Environmental Protection Agency shall submit to the Congress a report which shall include their recommendations, based upon an in-depth

review of all Federal, State, local, and industry contingency or oilspill emergeny response plans, for dealing with oilspills in connection with the exploration, development, and transportation of oil in the Gulf of Mexico and lower Mississippi River. The review shall include, but not be limited to, all plans dealing with such oilspills required by the Outer Continental Shelf Lands Act (43 U.S.C. 1331, et seq.), the Federal Water Pollution Control Act (33 U.S.C. 1251, et seq.), and the Deepwater Port Act of 1974 (33 U.S.C. 1501, et seq.).

(b) The review and report on contingency plan adequacy shall address, but not be limited to, the following subjects:

(1) The adequacy of the contingency or oilspill emergency response plan for dealing with potential oilspills;

(2) The adequacy and operational capacity of oilspill containment equipment, including, but not limited to, containment booms, oil skimming vessels, barge facilities, work vessels, oilspill dispersants and equipment for their application;

(3) The adequacy, training, preparedness, and fitness of all personnel assigned to direct and implement the contingency or oilspill emergency response plan;

(4) The adequacy of plans, personnel and prepositioned equipment for protecting wetlands, critical habitat, environmentally sensitive areas, and fisheries;

(5) The adequacy of onsite availability of chemical dispersants and dispersing systems; and

(6) The adequacy of arrangements for enlisting the use of non-oil-industry personnel and calling upon backup assistance from sources such as the national guard or the military.

TITLE III.—VESSEL DESIGN AND SPILL PREVENTION

SEC. 301. REPORT AND RECOMMENDATIONS ON SPILLS AND VESSEL DESIGN.—Within ninety days of the date of enactment of this Act, the Secretary shall submit to the Congress a report which addresses and makes recommendations on the following transportation issues related to the movement of oil through the Gulf of Mexico and the lower Mississippi River:

(a) A review of all recent oilspills in the Gulf of Mexico and the lower Mississippi River involving vessels, and whether any of these spills could have been prevented by requiring double hulls or double bottoms on such vessels, or requiring additional safety lines between towing vessels;

(b) The need or desirability, from a safety point of view, for a requirement that existing vessels engaged in the transport of oil be retrofitted and that new vessels engaged in the transport of oil be constructed to incorporate—

(1) double bottoms or interior liners to reduce oil spill risks;

(2) an increased number of separated compartments;

(3) bow thrusters to increase vessel maneuverability; and

(4) any other design, equipment, or operational feature which will achieve the purposes of this section and this Act to reduce the risk of oil discharges from tanker or other vessel accidents, groundings, or collisions.

(c) The need or desirability, from a safety point of view, for more frequent and more rigorous Coast Guard safety and structural inspections of all vessels engaged in the transportation of oil in the Gulf of Mexico and lower Mississippi River, including both in-water inspections and dry dock inspections, with special attention directed to older vessels and to vessels over seven hundred feet in length.

SEC. 302. REGULATIONS ON VESSEL CREW REQUIREMENTS AND TRAINING.—Effective within ninety days of the date of enactment of this Act, the Secretary shall issue regulations which—

(a) provide that the conditions for a masters license for any person required to have such license who is engaged in the operation of a vessel transporting oil in the Gulf of Mexico or the lower Mississippi River shall require that the license be renewed every two years and the license holder shall submit a copy of the required physical examination by a licensed physician to the appropriate Federal agency;

(b) provide that all required certificates of inspection for vessels engaged in the movement and transport of oil in the Gulf of Mexico or the lower Mississippi River direct and require that all watches on board ship be redundantly manned to insure backup personnel and second opinions on radar monitoring and critical navigation decisions; and

(c) provide to the maximum extent practicable more stringent recruiting, personnel, and job training standards for all personnel and crew operating or crewing vessels engaged in the movement or transport of oil in the Gulf of Mexico or the lower Mississippi River

for the purpose of enhancing safety and reducing future risks of oil spill to the lowest level humanly possible.

SEC. 303. EQUIPMENT STANDARDS.—Not later than one year after the date of enactment of this Act, the Secretary shall issue a final rule listing the equipment that must be carried by vessels transporting oil in the Gulf of Mexico or the lower Mississippi River to carry out the oilspill cotingency plans required by section 202 of this Act.

SEC. 304. INSPECTION AND MAINTENANCE.—The Secretary shall implement regulations providing for inspection of vessels transporting oil in the Gulf of Mexico or the lower Mississippi River to ensure that each vessel is in compliance with the oilspill contingency plan required by section 202 of this Act, and to ensure that equipment required by section 303 of this Act is onboard and in good working order.

TITLE IV—NO IMPACT ON STATE LAW OR ON LIABILITY UNDER OTHER LAW

SEC. 401. STATE LAWS AND PROGRAMS.—Nothing in this Act shall be construed or interpreted as preempting any State from imposing any liability or other requirements with respect to oilspills or to the discharge of oil within such State.

SEC. 402. LIABILITY FOR OILSPILLS OR DISCHARGES OF OIL NOT AFFECTED BY THIS ACT.—(a) Nothing in this Act shall affect or modify in any way the obligations or liabil-

ities of any person under other Federal or State law, including common law, with respect to oilspills or the discharge of oil.

(b) Nothing in this Act shall absolve any person of any obligations or liabilities, or reduce the obligations or liabilities of any person, under existing Federal or State law, including common law, with respect to oilspills or discharges of oil occurring prior to the date of enactment of this Act.

TITLE V—PENALTIES

SEC. 501. (a) CIVIL PENALTIES.—A person violating any provision of titles II and III of this Act or a regulation issued under such titles is liable to the United States for a civil penalty of not more than $25,000. Each day of a continuing violation is a separate violation.

(b) VESSELS.—Each vessel to which titles II and III apply that is operated in violation of such titles or a regulation issued under such titles is liable in rem for a civil penalty as prescribed in subsection (a) of this section.

(c) CRIMINAL PENALTIES.—A person willfully and knowingly violating any provision of titles II and III of this Act or a regulation issued under such titles shall be fined not more than $100,000, imprisoned for not more than five years, or both.

(d) JURISDICTION.—The district courts of the United States have jurisdiction to restrain a violation of any provi-

sion of titles II and III of this Act or a regulation issued under such titles.

TITLE VI—COOPERATIVE DEVELOPMENT OF COMMON HYDROCARBON-BEARING AREAS

SEC. 601. COOPERATIVE DEVELOPMENT OF COMMON HYDROCARBON-BEARING AREAS.—Section 5 of the Outer Continental Shelf Lands Act, as amended (42 U.S.C. 1334), is amended by adding a new subsection (j) as follows:

"(j) COOPERATIVE DEVELOPMENT OF COMMON HYDROCARBON-BEARING AREAS.—

"(1) FINDINGS.—

"(A) The Congress of the United States finds that the unrestrained competitive production of hydrocarbons from a common hydrocarbon-bearing geological area underlying the Federal and State boundary may result in a number of harmful national effects, including—

"(I) the drilling of unnecessary wells, the installation of unnecessary facilities and other imprudent operating practices that result in economic waste, environmental damage and damage to life and property;

"(II) the physical waste of hydrocarbons and an unnecessary reduction in the amounts

of hydrocarbons that can be produced from certain hydrocarbon-bearing areas; and

"(III) the loss of correlative rights which can result in the reduced value of national hydrocarbon resources and disorders in the leasing of Federal and State resources.

"(2) The Secretary shall prevent the harmful effects of unrestrained competitive production of hydrocarbons from a common hydrocarbon-bearing area underlying the Federal and State boundary by protecting against drainage through the cooperative development of such area.

"(3) Whenever it shall appear that Federal oil and gas resources on the Outer Continental Shelf are being drained, or are about to be drained, by a State or any lessee, permittee or agent of a State, the Attorney General may institute a civil action in the district court of the United States for the judicial district in which the lease or land involved is located, for a temporary restraining order, injunction, or other appropriate remedy, in order to prevent the drainage of Federal oil and gas resources. Such relief shall be granted if it appears that Federal oil and gas resources on the Outer Continental Shelf are being drained or are about to be drained and the Secretary and the Governor do not

agree as to the method of cooperative development of the common hydrocarbon-bearing area, including the fair and equitable apportionment of the oil and gas resources involved. Such temporary restraining order, injunction, or other appropriate remedy shall remain in full force and effect until such time as the Secretary and the Governor of the State reach agreement on such method of cooperative development and apportionment of resources or until the court enters a final judgment on the merits of the matter.

"(4) Whenever it shall appear that State oil and gas resources on the Outer Continental Shelf are being drained, or are about to be drained, by the United States or any lessee, permittee, or agent of the United States, the State may institute a civil action in the district court of the United States for the judicial district in which the lease or land involved is located, for a temporary restraining order, injunction, or other appropriate remedy, in order to prevent the drainage of State oil and gas resources. Such relief shall be granted if it appears that State oil and gas resources on the Outer Continental Shelf are being drained or are about to be drained and the Secretary and the Governor do not agree as to the method of cooperative development of the common hydrocarbon-bearing area, including the fair and equitable apportionment of the oil and gas resources involved. Such

temporary restraining order, injunction, or other appropriate remedy shall remain in full force and effect until such time as the Secretary and the Governor of the State reach agreement on such method of cooperative development and apportionment of resources or until the court enters a final judgment on the merits of the matter.".

The CHAIRMAN. We begin today with a panel composed of Dr. Paul Templet, Secretary of the Department of Environmental Quality here in Baton Rouge; Colonel Richard Gorski, our new Corps of Engineers representative in New Orleans; Ms. Virginia Van Sickle who is Secretary of the Louisiana Department of Wildlife and Fisheries in Baton Rouge; and Dr. Michael Loden who is Environmental Director in Jefferson Parish Louisiana.

What I would like to do is receive the testimony of each of our distinguished witnesses this morning and then after all have finished, we can allow for questioning and for some interchanging. So let us begin with Dr. Paul Templet. Glad to have you Doctor.

STATEMENT OF DR. PAUL TEMPLET, SECRETARY, LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY

Dr. TEMPLET. Thank you Senator Johnston, members of the committee, ladies and gentlemen. I appreciate the opportunity to address this committee on the subject of Louisiana's wetlands and their preservation and restoration. The proposed "wetlands provision" in Senate Amendment No. 229 which will set up the Wetlands Account, is a much needed piece of legislation that should greatly assist the State in beginning the task of restoring our wetlands.

Louisiana's wetland loss is about 80 percent of the total U.S. wetland loss, coastal wetland loss. Entire parishes or counties will be lost within 50 years and the loss rate is increasing. We have lost over a million acres so far which is an area about one and one-third times that of Rhode Island.

The stakes in this issue are enormous. The nation's largest annual fisheries yield, massive economic investments, social amenities, including the heritage of the Cajuns of Louisiana.

Louisiana wetlands are an irreplaceable national treasure and produce, not inconsequentially, about a billion dollars worth of revenue for Louisiana each year. Human intervention aimed at enhancing navigation and flood control is responsible for these staggering physical losses. As levees have increasingly confined the geologically roving river to a fixed channel to prevent flooding and enhance navigation, the sediments traditionally deposited by the River in the adjacent wetlands are now retained within the river banks and deposited into deep water off the edge of the continental shelf. Lost forever is the land building resource. The wetlands are subsiding in an average rate annually of about one-half inch. They are building at about a quarter of an inch from other sources, but the quarter of an inch difference there, the deficit, is the sediment that the Mississippi River used to provide before the levees were built.

The problem is further aggravated by canal building associated with oil and gas development activities, including Outer Continental Shelf development. A recent MMS study (mineral management service study) attributed a significant portion of the lost to OCS development activities.

Federal policy and the resultant institutional arrangements maintain the nearly total dedication of the River's resources to navigation causing the continued and accelerating degradation of

the environment, and increasingly, the economy of south Louisiana. The existing policy promotes spending billions of dollars for confinement of the River and pennies for environmental problem solving. Continued adherence to this approach will lead to the greatest environmental catastrophe this country has experienced. At issue is a contradictory Federal policy which seeks to confine the River for the benefit of navigation, and at the same time (but not with the same vigor) to preserve wetlands as a habitat for fisheries and other wildlife.

It is possible to do both but not with the existing expressions of policy. Both uses of the River are in the national interest, therefore, the solution to the problem lies in changing Federal policy through Congressional action and a realistic reevaluation of the available alternatives which could maintain navigation and flood control without sacrificing the wetlands of south Louisiana. The only long-term solution is to provide more sediment to the wetlands. Short-term solutions include reduce dredging, water management, pollution reduction and barrier island restoration.

In order to reverse the land loss process and restore some of the lost wetlands, I propose a Regional Water Management Approach which would be a large-scale comprehensive plan for wetland protection and management. It offers a means to integrate various techniques in offering solutions to address the wetland loss. The approach involves expanding and reorienting the present goals for allocating Mississippi River water from only navigation and flood control to give equal weight to wetland restoration. This could be accomplished through the following proposed tactics:

1. Implement of phased diversion of Mississippi River waters into the Atchafalaya on an estimated one percent to two percent per year basis until we reach about 50 percent in ten years. This will partially reinstate the long-period sedimentation event. The reason there is simple. The Atchafalaya River is building a delta, the Mississippi River is not.

2. Use the spring pulse flood of the Mississippi River (December through June) to inundate deltaic wetlands as the major short-period sedimentation event of each year. Use low-level sills in the lower Mississippi levees to move spring flood waters into adjacent wetlands.

3. Use former distributaries of the Mississippi River to move water and sediments into the deltaic plain wetlands.

4. Reroute navigation traffic out of the lower Mississippi above Head of Passes and promote delta building in the lower Barataria, Mississippi, and Pontchartrain Basins to offset the deterioration. This is the only way to capture the heavy bed load material which nourishes the barrier islands and wetlands.

5. Encourage delta building in the Atchafalaya Bay by relocating the existing navigation channel to a location less detrimental for sediment distribution and delta growth. Wax Lake Outlet is recommended.

6. Create many small diversions from these main channels.

7. Use canal acreage reduction, barrier island restoration, and regulatory approaches to complement and increase the effectiveness of the diversions.

8. Use all dredge spoil from Army Corps projects to create wetlands or barrier islands. In many cases we are not using the spoils effectively.

9. And lastly, Implement the authorized and planned U.S. Army Corps of Engineers diversions, but redesign (where feasible) to maximize sediment introduction instead of water introduction.

Most of these recommendations have been included in the Louisiana Plan which we are now trying to implement with the Army Corps of Engineers.

I commend you for your efforts to use a portion of the OCS revenues for wetland restoration. For years we have borne the environmental impacts which resulted in loss of wetlands with no compensation. It's only equitable to use some of those monies to help reverse the land loss trend.

I am including two of my papers which have led me to these conclusions and a copy of the recommendations for modification of existing project authorities.

I thank you again for this opportunity to address your Committee.

[The prepared statement of Dr. Templet follows:]

State of Louisiana

Department of Environmental Quality

BUDDY ROEMER
Governor

PAUL TEMPLET
Secretary

Statement to the Senate Committee on Energy and Natural Resources
August 31, 1989 -- Baton Rouge, LA
by Dr. Paul Templet, Secretary
Louisiana Department of Environmental Quality

Senator Johnston, Members of the Committee, Ladies and Gentlemen, thank you for inviting me to speak to your Committee on the vital subject of the preservation and restoration of Louisiana's coastal wetlands. The proposed "wetlands provision" in Senate Amendment No. 229, which will set up the Wetlands Account, is a much needed piece of legislation and should greatly assist the state in beginning the task of restoring our wetlands.

Louisiana's wetland loss represents approximately 80% of the total U.S. coastal wetland loss. Entire parishes (counties) will be lost within 50 years. The loss rate is increasing exponentially, and, since 1900, Louisiana has lost approximately 4,400 square km (1,680 square miles) of deltaic wetlands (over one million acres), an area one-and-one-third times that of Rhode Island.

The stakes in this issue include the nation's highest annual fisheries yield. Also at stake are massive economic investments and social amenities, including the heritage of one of the U.S.'s largest unassimilated distinct cultural groups, the Cajuns of south Louisiana.

Human intervention aimed at enhancing navigation and flood control is responsible for these staggering physical losses. As levees have increasingly confined the geologically roving River to a fixed channel to prevent flooding, the sediments traditionally deposited by the River in adjacent wetlands are now retained within the riverbanks and deposited into deep water off the edge of the continental shelf--lost forever as a land-building resource. The wetlands are subsiding at an average rate of approximately l/2 inch/yr. and building (accreting) only l/4 inch/yr. The l/4 inch deficit is the sediment the Mississippi River used to provide before the levees were built.

The problem is further aggravated by canal building associated with oil and gas development activities, including Outer Continental Shelf (OCS) development. A recent Mineral Management Study attributed a significant portion of the loss to OCS development activities.

Federal policy and the resultant institutional arrangements maintain the nearly total dedication of the River's resources to navigation, causing the continued and accelerating degradation of the environment and, increasingly, the economy of south Louisiana. The existing policy promotes spending billions of dollars for confinement of the River and pennies for environmental problem solving. Continued adherence to this approach will lead to the greatest environmental catastrophe this country has experienced.

Only recently have technical studies sponsored by the federal agencies begun to recognize their roles in south Louisiana's enormous environmental problems. There is still insufficient recognition of the inherent policy roots of the crisis. At issue is a contradictory federal policy which seeks to confine the Mississippi River in its present channel for the benefit of navigation and, at the same time (but not with the same vigor), to preserve wetlands as a habitat for fisheries and other wildlife.

It is possible to do both but not with the existing expressions of policy. Both uses of the River are in the national interest; therefore, the solution to the problem lies in changing federal policy through Congressional actions and a realistic reevaluation of the available alternatives which could maintain navigation and flood control without sacrificing the wetlands of Louisiana.

The only long-term solution is to provide more sediment to the wetlands. Short-term solutions include reduced dredging, water management, pollution reduction and barrier island restoration.

In order to reverse the land loss process and restore some of the lost wetlands, I propose a Regional Water Management Approach which would be a large-scale comprehensive plan for wetland protection and management. It offers a means to integrate various techniques in offering solutions to address wetland loss. The approach involves expanding and reorienting the present goals for allocating Mississippi River water from only navigation and flood control to give equal weight to wetland restoration. This could be accomplished through the following proposed tactics:

1. Implement a phased diversion of Mississippi river waters into the Atchafalaya on an estimated 2% per year basis until 50% is reached in ten years. This will partially reinstate the *long-period* sedimentation event.
2. Use the spring flood pulse of the rivers - December through June-to inundate deltaic wetlands as the major *short-period* sedimentation event of each year. Use low-level sills in the lower Mississippi levees to move spring flood waters into adjacent wetlands.
3. Use former distributaries of the Mississippi River to move water and sediments into the deltaic plain wetlands. Bayous Lafourche, Barataria, Grande Cheniere, Grand Liard and existing spillways are suggested.

4. Reroute navigation traffic out of the lower Mississippi River above Head of Passes and promote delta building in the lower Barataria, Mississippi, and Pontchartrain Basins to offset the present deterioration. This is the only way to capture the heavy bed load material which nourishes the barrier islands.
5. Encourage delta building in the Atchafalaya Bay by relocating the existing navigation channel to a location less detrimental for sediment distribution and delta growth. Wax Lake Outlet is recommended.
6. Create many small diversions from these main channels to move water efficiently into the sinking wetlands.
7. Use canal acreage reduction, barrier island restoration, and regulatory approaches to complement and increase the effectiveness of the diversions.
8. Use all dredge spoil from Army Corps projects to create wetlands or barrier islands.
9. Implement the authorized and planned U.S. Army Corps of Engineers' diversions, but redesign, where feasible, to maximize sediment introduction instead of water introduction.

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Most of these recommendations have been included in the Louisiana Plan which we're now trying to implement with the Corps.

I commend you for your efforts to use a portion of the OCS revenues for wetland restoration. For years we've borne the environmental impacts which resulted in loss of wetlands with no compensation. It's only equitable to use some of those monies to help reverse the land loss trend.

I am including two of my papers which have led me to these conclusions and a copy of recommendations for modification of existing project authorities.

Thank you again for this opportunity to address your Committee.

The Policy Roots of Louisiana's Land Loss Crisis, Presented at Coastal Zone 87 and published in proceedings, Fifth Symposium on Coastal and Ocean Management, May 26-29, 1987, Seattle, Wash.

The Policy Roots of Louisiana's Land Loss Crisis

Paul H. Templet*

Abstract

Louisiana is currently losing approximately 155 square kilometers (60 square miles) of highly productive wetlands to the Gulf of Mexico each year (42 ha/day) and the rate is accelerating. Slightly over 1% of Louisiana's vast coastal wetlands, estimated at 41% of the nations total, are lost each year. Louisiana's wetland loss represents approximately 80% of the total U.S. coastal wetland loss. Entire parishes (counties) will be lost within 50 years. The loss rate is increasing exponentially, and, since 1900, Louisiana has lost approximately 4,400 square km (1,680 square miles) of deltaic wetlands (over one million acres), an area one-and-one-third times that of Rhode Island).

The stakes in this issue include the nation's highest annual fisheries yield. Also at stake are massive economic investments and social amenities, including the heritage of one of the U.S.'s largest unassimilated distinct cultural groups, the Cajuns of south Louisiana.

The physical cause of the problem lies in man's attempts to control the Mississippi River's flooding and to enhance navigation. Secondary (and possibly primary) causes include erosion, canalization, sea level rise, hydrologic modification, and direct conversion of wetlands to other uses. As levees have increasingly confined the geologically roving River to a fixed channel and prevented overbank flooding, the sediments traditionally deposited by the River in adjacent wetlands are now retained within the riverbanks and deposited into deep water off the edge of the continental shelf–lost forever as a land-building resource.

Federal policy and the resultant institutional arrangements maintain the nearly total dedication of the River's resources to navigation, causing the continued and accelerating degradation of the environment and, increasingly, the economy of south Louisiana. The existing policy is one of billions for confinement of the River and pennies for environmental problem solving. This approach, if followed for much longer, will lead to the greatest environmental catastrophe this country has experienced. Only recently have technical studies sponsored by the federal agencies begun to recognize their roles in south Louisiana's enormous environmental problems. There is still no sign of their recognition of the inherent policy roots of the crisis.

At issue is a contradictory federal policy which seeks to maintain the Mississippi River in its present channel for the benefit of navigation and, at the same time (but not with the same vigor), to preserve wetlands as a habitat for fisheries and other wildlife. It is possible to do both but not with the existing expressions of policy. Both uses of the River are in the national interest; therefore, the solution to the problem lies in changing federal policy through Congressional action and a realistic reevaluation of the available

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alternatives which could maintain navigation and flood control without sacrificing the wetlands of South Louisiana.

Introduction

The Mississippi River deltaic plain of southern Louisiana is one of the most productive ecosystems in the world. Created from sediments deposited by a river system that drains 41% of the United States, the deltaic plain contains a similar percentage of the nation's coastal wetlands. As a consequence, the annual biological productivity is quite high: fish and shellfish are the leading commercial products, and each year Louisiana ranks first in the United States in tonnage of fisheries landings--over 1 billion pounds annually. Many Louisianians who live along the low natural levees of former Mississippi River channels and distributaries have traditionally made their living by harvesting the abundant resources of the local environment.

When sea level last stabilized at its present position about 7,000 years ago, the Mississippi River was depositing its sediments at the approximate latitude of Baton Rouge, which is now some 100 miles inland from the Gulf of Mexico. Over that span of time, the River created seven deltas (Coleman and Gagliano 1964; Frazier 1967) by a process of delta switching in which the River abandoned its channel every 1000 years or so and found a new route to the Gulf. The abandoned delta began to erode, and a new delta was created at the distal end of the active watercourse. This process created the present deltaic plain and extensive coastal wetlands of south Louisiana, and the process resulted in a large net gain of new land until about 100 years ago when human intervention brought about a reversal of the trend.

In recent decades it has become obvious that the deltaic environment is rapidly deteriorating. Extrapolation of recent studies (Salinas et al., 1986; and Sasser et al., 1985) puts the land loss rate in one of the deltaic basins (Barataria) at slightly above 1.8% per year for1980 and increasing rapidly, a doubling time of 39 years. In 1980, the land loss rate was approximately 104 square km/yr (40 square miles/yr) for the deltaic plain (Gagliano et al., 1981) and 130 square km/yr (50 square miles/yr) overall for coastal Louisiana. Extrapolating from the latter studies puts the loss at nearly 155 square km (60 square miles) in 1987 (slightly over 100 acres per day) or, to put it another way, an area the size of Washington D.C. each year. The land loss rates have increased geometrically and will most likely continue to do so. Wetland acreage loss in the interval 1900 to 1985 exceeds 4,400 square km (1.1 million acres). The lost land, valued at a conservative $10,000/ha ($4,000/acre) in terms of natural services (e.g., recreation) and productivity (e.g., fish, shellfish, fur), represents a loss to Louisiana and the nation which exceeds 4 billion dollars.

Disappearance of the wetlands means more to Louisiana and the United States than loss of the prevailing resource base. Life and property are increasingly threatened as the populated, low-elevation natural levee lands become more exposed to the Gulf of Mexico. The loss of storm-buffering protection provided by wetlands and barrier islands not only jeopardizes the safety of isolated bayou communities but also the New Orleans metropolitan area. The potential impact of a hurricane directly striking the city is much more serious today than in decades past because of the increased storm surge levels exacerbated by adjacent open water conditions.

Various solutions have been suggested to remedy the tremendous environmental problems at hand. Proposals have included: puncturing the levees to allow Mississippi River sediments to re-enter the wetland basins; diverting more of the Mississippi's waters down the Atchafalaya River, its principle distributary; building giant protection

levees across the wetlands; restoring the rapidly disintegrating barrier islands; and, backfilling canals dredged through the marshes. Although each of the individual proposals contains merit, it is becoming apparent that a large-scale, comprehensive approach to wetland protection must be taken to insure optimum return for the effort expended. A regional plan is required to integrate the various components.

Existing federal policy dedicates the management of the Mississippi River to maintaining navigation and promoting flood control. These are laudable goals, but they need not be practiced to the near total exclusion of other legitimate uses of the River's waters, sediments, and nutrients. Other suggested uses include wetland restoration, salinity reduction, habitat creation and improvement, and improved productivity. Navigation, flood control, and environmental enhancement can coexist; however, present policy inhibits efforts to find acceptable solutions to the environmental problems.

The Causes of the Problem

The causes of land loss can be attributed to a combination of natural and human-induced processes, of which perhaps the most detrimental is the reduction of available sediment to the wetlands. Prior to European settlement along the Mississippi River, various fluvial processes, such as overbank sedimentation, crevassing, channel bifurcation, and delta-switching, caused the naturally subsiding deltaic plain to grow in area and elevation. Artificial levees were built on the riverbanks to minimize flooding as European and American settlers moved in during the 18th and 19th centuries. Rivermouths were jettied to improve navigation, and active distributary channels were plugged or replaced by lock-and-dam structures. As more of the River's flow became confined in its channel, correspondingly less of its sediment load was available to nourish the wetlands and counterbalance the ongoing process of regional subsidence. Periodically the Mississippi River overpowered human technology and broke through levees, although fluvial processes have been largely confined to their channels and active delta since the U.S. Army Corps of Engineers was assigned the twin tasks of maintaining navigation and providing flood control. Also, the sediment load carried by the River has been diminished in recent years, caused by dams on the tributaries, reduction in topsoil erosion in the Midwest, mining of sands and gravels from pointbars, and on-land disposal of dredged fluvial sediments (Keown et al., 1980).

As sediments were prevented from entering the wetlands, the marshes began to experience what has become known as marsh accretion deficit. Traditionally, marshes built upward by a combination of producing in-situ organic sediments and trapping introduced mineral sediments. Organic production has not been able to account for sufficient vertical marsh accretion to keep pace with the rate of subsidence since the elimination of the mineral sediment and nutrient input from the Mississippi River. Only streamside marshes, subject to tidal waters overflow receive enough mineral sediments to maintain themselves. While prevailing subsidence rates of 1.2 to 1.3 cm/year are estimated, inland marsh accretion rates have been measured at only 0.67 to 0.78 cm/year (DeLaune et al., 1978, 1983; Hatton et al., 1983). In other words, marshes inland from the edge of water bodies cannot build up fast enough to keep pace with the combined processes of subsidence and sea level rise, and, as a consequence, are rapidly submerging and breaking up.

At the same time that man was harnessing the river that literally fed the system, the wetlands themselves were being directly destroyed by canal dredging and wetland reclamation activities. Canals, originally dredged for drainage and navigation, now are overwhelmingly related to the petroleum industry. Oil-rig access canals, pipeline canals, and deep-draft navigation channels for oil-industry support vessels have left a

hodge-podge of linear scars upon the formerly unmarred wetlands. Although canals are estimated to comprise about 2.5% of the total coastal surface area, their destructive impact has been much greater (Craig et al., 1979; Turner et al., 1982). Spoil banks composed of the material dredged from the canals tend to smother adjacent marshes, thereby converting wetlands to functional uplands and interrupting natural hydrologic processes. Water-filled levee-flank depressions often result. Canals dredged transverse to water flow tend to interrupt sheet flow, impound water, and cause deterioration of marshes. Canals dredged in alignment with water flow tend to lessen freshwater retention time and allow greater inland penetration of saltwater. The wakes generated by boats erode the banks, and many canals have widened tremendously since they were first dredged (Craig et al., 1979). Some researchers have suggested that as much as 90% of Louisiana's land loss can be attributed to canalization (Turner et al., 1982). The mechanism by which canals and spoil banks cause land loss involves hydrologic disruption which interferes with sediment deposition.

Reclamation of wetlands for agricultural, urban or industrial expansion also has contributed to land loss. Large agricultural reclamation schemes in the early 20th century were the most detrimental, and several large rectangular waterbodies stand as mute testimony to man's ill-fated efforts.

A number of natural processes are held accountable for Louisiana's high land loss rates, including subsidence, sea level rise, wave erosion, and saltwater intrusion. But man has played such a large role in contributing to the accelerated severity of these processes that the "natural" component must be de-emphasized. Subsidence, already described as an integral part of the natural system, appears more dominant today because the counterbalancing fluvial sediments have been impeded. Also, subsurface hydrocarbon withdrawal may be partly responsible for increased subsidence. Sea level rise, too, is largely a man-made phenomenon associated with global warming stimulated by the use of halogenated hydrocarbons and the burning of fossil fuels, which have led to accelerated CO_2 buildup in the atmosphere. The last of these "natural" processes--saltwater intrusion--is technically a response to a variety of processes (e.g., subsidence, sea level rise, canal dredging). Increased salinization and degradation of wetlands caused by saltwater intrusion is most directly linked to man-made levees, which cut off the Mississippi River's fresh water and sediments.

Sea Level Rise

The U.S. Environmental Protection Agency, on the basis of past trends, has outlined future scenarios of sea level rise, ranging from 4.8 to 17.1 cm by the year 2000 and from 56.2 to 345.0 cm by the year 2100 (Hoffman et al., 1983; Table 1). Nummedal (1983) has projected eustatic (world-wide) sea level rise rates as high as 1 cm/year to the year 2020, and an overall relative sea level rise in Louisiana (including subsidence) of 69 to 75 cm by that same year.

Table 1. Scenarios of future sea level rise (in cm) (after Hoffman et al., 1983).

SCENARIO	YEAR						
	2000	2020	2025	2050	2075	2080	2100
high	17.1		54.9	116.7	211.5		345.0
mid-range high	13.2		39.3	78.9	136.8		216.6
mid-range low	8.8		26.2	52.6	91.2		144.4
low	4.8		13.0	23.8	38.0		56.2
current trends (national)[1]	2.5		5.7	8.8	11.9		15.0
current trends (Louisiana)[2]	21.3		52.5	83.8	115.0		146.3
current trends (Louisiana)[3]		72				142	

1 mid-range of values (Hoffman et al., 1983)

2 straight-line projections of relative sea level rise values (1.25 cm/yr) (Baumann and DeLaune, 1982)

3 mid-range of values cited in Nummedal (1983) (includes 1 cm/yr eustatic sea level rise for the 1980-2020 period)

The implications of these sea level rise projections are quite serious to the wetlands of coastal Louisiana. Any rise in sea level without at least a corresponding vertical input of sediment will increase the sediment accretion deficit and lead to accelerated submergence and deterioration of the coastal marshes. The marshes in the deltaic plain have traditionally experienced apparent sea level rise (subsidence and actual sea level rise) and only maintained themselves as long as they received sediments from the River.

Problem-Solving Strategies

To combat the debilitating impacts of land loss, four major categories of remedial actions can be readily delineated–sediment diversions, marsh management, barrier island restoration, and regulatory approaches. All of these lend themselves to varying levels of implementation, from small piecemeal "band-aid"-type approaches to large comprehensive projects.

Because sediment deficit is the leading cause of marsh breakup, a logical solution would be to divert fluvial sediments into the marshes to help offset the erosionary trend. Diversions can take several forms: increasing the percentage of Mississippi River discharge through the Atchafalaya River distributary; reoccupation of formerly active distributary channels; uncontrolled diversion along the lower Mississippi River; or controlled diversion by means of control structures.

The strategy for marsh management and restoration entails the implementation of various tactics that will improve the quality of wetlands or at least prevent further deterioration. These tactics vary from building new marshes with dredged material to revising existing wetlands policies. The most common method is to alter the marshes by levees, wiers, floodgates, and occasionally by introduced sediment so that proper water levels and salinities can be artificially controlled for selected species productivity. Ideally, marsh management should be combined with sediment diversion (or introduction of dredged material) because the fundamental problem is a sediment deficit. However, substantial habitat improvement can be undertaken on a smaller, localized scale.

The first line of defense against incoming hurricanes and severe storms is Louisiana's barrier islands and beaches. These physiographic features owe their origin to processes of wave erosion, yet they also diminish the impact of incoming storm waves. Because the barrier islands and beaches have been eroding at high rates during the last few decades, a major restoration strategy focuses on rebuilding the effectiveness of the barriers and beaches. To best restore the shore and still conform to natural processes requires the input of sediment. Beaches can be nourished by using compatible sands dredged from offshore or pumped from riverine dredge sites. Barrier islands can be widened, washovers and breaches sealed, backbarrier marshes restored, and vegetation can be planted to stabilize newly deposited sediments. The Louisiana Geological Survey is presently involved in implementing barrier restoration projects along critical portions of the Louisiana coast.

A final and critical strategy involves combatting land loss at the institutional level. In addition to calling for a master land-use plan, it incorporates a myriad of regulatory tactics (Table 2). Additionally, mitigation legislation, cost-benefit analyses of potential U.S. Army Corps of Engineers projects, and tax incentives, could address potential wetlands impacts, if implemented.

Table 2. Examples of regulatory tactics to combat land loss processes (Templet and Meyer-Arendt, 1986).

Land Loss Component	Potential Regulation
a. decrease in sediment quality	1. moratorium on sand & gravel mining 2. dispose of Miss. River dredged material in more optimal locations
b. canalization	1. utilize existing canals for oil and gas access 2. require use of directional drilling techniques 3. establish pipeline canal "corridors" 4. establish spoil deposition guidelines
c. subsidence	1. establish weight/unit area guidelines for construction 2. require proper fluid reinjection and pressurization 3. minimize water level drawdown in drainage districts 4. restrict marsh buggy traffic
d. sea level rise	1. require minimum floor heights in new housing 2. establish moratorium on direct coastal construction 3. establish setbacks on new development, including municipal utilities and services
e. wave erosion	1. ban "hard" structural shore protection methods (e.g., groins, seawalls, & revetments) 2. ban offshore dredging within 2000 feet of shoreline 3. ban shell dredging within protective reefs (e.g., Point au Fer, Marsh Island) 4. limit commercial boat traffic to select waterways 5. establish speed limits for commercial craft
f. saltwater intrusion	1. require installation of water/salinity control structures on new canals

Although there are several apparent contributors and solutions to Louisiana's land loss problems, the sediments, water, and nutrients carried by the Mississippi River are the lifeblood of the coastal wetlands. The water keeps the salinity regime in balance, the nutrients promote plant growth, and the sediments provide the base that keeps the plants above sea level. All are necessary for the wetlands to sustain themselves. The dominant cause of the land loss problem is that the coastal wetlands do not receive enough of the Mississippi River's flow (as they have historically) to offset the continual subsidence and sea level rise. Canals and their associated spoilbanks also restrict sheet flow and prevent sediment distribution. Getting sufficient Mississippi River flow into the coastal wetlands of Louisiana must involve Federal policy as the River is controlled by Congressional policy directives.

Existing Federal Navigation and Flood Control Policy

Federal policy concerning navigation and flood control on the Mississippi River has its origins in the development history of the River. Man has been seeking ways to control the Mississippi since Bienville ordered his engineer to construct levees in the early 1700's for the protection of New Orleans, even as it was being founded. Levee building continues up to the present. The early levees were locally funded, uneven, and frequently gave way to the floods which came every spring. Beginning in 1917, the expenditure of federal funds directly for flood control purposes was authorized on a two-thirds federal/one-third local cooperative basis. In 1927 one of the greatest floods to hit Louisiana breached the levees and inundated 60,000 square km (23,000 square miles). Damage was extensive and 414 lives were lost. The next year Congress recognized the national interest in preventing flooding on the Mississippi by authorizing the Flood Control, Mississippi River and Tributaries Project (Act of May 15, 1928, 70th. Congress) to provide a comprehensive plan of flood control. Implementation was 100% federally funded. The plan also included provisions for flood overflows to be diverted into the Atchafalaya River and lakes and other basins in Louisiana

The choice of linear levees to confine the River in the name of flood protection was probably influenced by the Corps' earlier concern for navigation. Throughout the history of this country, the battle to keep the River open for navigation at its delta has been waged, at first with giant plows and dredges (Houck, 1983). A novel solution was proposed by Captain James B. Eads, who had built the first bridge across the Mississippi River at St. Louis. Eads proposed a solution in the early 1870's which involved levees and jetties to constrain the River, decreasing the size of the floodplain, and thus increasing the rate of flow of the River so that it would scour its own bed and maintain a channel for navigation. His plan was completed in 1878, and it worked. Linear levees along the whole length of the lower River seemed to solve both the flooding and the navigation problems. Confining the River became the accepted way to manage it, and that approach has since been codified into law and subsequent policies, even though other alternatives were proposed which might have prevented the environmental losses (Viosca, 1927).

There were alternatives to linear confinement of the River: ring levees to prevent flooding of existing development; land-use controls to guide development to areas with minimal flooding; continued dredging to maintain draft for navigation; removing navigation from the River north of its active delta lobe; a lock and dam in the Mississippi River below Old River or at the River's mouth; keeping distributaries open; controlling inflow further upstream; artifical lakes; stream control at the headwaters

and tributaries; diversions (Viosca's "relief outlets" (1927)); and, spillways. These were not chosen, however, and may not even have been considered.

A development which further entrenched the policy of confinement was the near switching of the Mississippi River in the early 1950's to the present channel of the Atchafalaya River, its largest distributary. The Atchafalaya channel represents a shorter route to the Gulf of Mexico (229 vs 508 km) and has a steeper gradient. The capture was prevented by a structure completed in 1963, the Old River Control Structure (ORCS), which regulates the water so that only 30% of the Mississippi's flow can go into the Atchafalaya. The ORCS was authorized by the Flood Control Act of 1954 (PL 780, 83rd. Congress, 1954), which modified the 1928 act to regulate the flow of water into the Atchafalaya. The change that the River was trying to effect was a natural phenomenon which has occurred every 800 to 1,000 years as the River abandons its active delta and begins to build a new one elsewhere in its flood plain.

The report (USACOE, 1952) supporting the 1954 Act contains the rationale which has led to the present policy of allowing only 30% of the Mississippi River's flow to pass into the Atchafalaya River. The report states that "The distribution of flow and sediment in the Mississippi and Atchafalaya Rivers is now in desirable proportions and should be so maintained." A number of reasons are given for maintaining the Mississippi as the main channel, including the large amount of funds already spent on the lower Mississippi,as well as the large amount that would have to be spent on the Atchafalaya if it were to become the main channel, and maintaining flows in the Mississippi to prevent saltwater intrusion up the Mississippi River. There is little biological or environmental information and its bias toward navigation is exemplified by statements like "No modification of the existing project should be considered which does not safeguard the interests of navigation...." There is no discussion of the relative merits of different proportions in the split of water between the two rivers. Several state and federal agencies, in their comments on House Document 478, expressed environmental concerns, but there is nothing in the document to indicate that they were ever considered. The only other plans given serious consideration were alternative sites for the ORCS. The immense environmental and natural service benefits were either not understood or were ignored in the haste to control the River for economic development through engineering means.

Later consideration given to allowing different proportions of water in the two rivers is found in the Draft Environmental Impact Statement (EIS) on the Atchafalaya Floodway System (USACOE, 1981), which lists impacts of increased sedimentation in the Atchafalaya channel and basin, the risk of changing the course of the Mississippi River, destabilized flows at the ORCS, and flooding on the Atchafalaya River as a result of changing flow ratios. Based on this rather cursory analysis, all further consideration of changing the flow ratios was rejected. All alternatives evaluated in the draft EIS maintained the present 70:30 ratio, thus preventing a full treatment, including a benefit/cost ratio, of the value of different ratios for preventing land loss.

The Final EIS (USACOE, 1982) also listed alternatives to the existing 70:30 split. In the preliminary evaluation stage, one of the ten alternatives considered had a 60:40 split, and its preliminary first cost and annual cost were among the lowest. An agency management group ranked it "best" in 7 of 13 categories (USACOE, 1982, Table B-2-2), better than any other alternative, but it was eliminated from further consideration and was not evaluated in detail. Perhaps significantly, it was rated poorly in the navigation category. The reasons given for rejecting this and other possible flow configurations are primarily related to hydraulic considerations (USACOE, 1982,V2,p.C-29) developed in a study prior to the National Environmental Policy Act

(USACOE, 1952). Thus, without a full evaluation or appreciation of the impacts on south Louisiana, the policy die was cast!

Recommended New Policy

What is required to begin solving Louisiana's land loss problem is a new policy for controlling the management of the lower Mississippi River system, which recognizes the legitimate needs of the wetlands for the River's nourishing water and sediments while maintaining navigation and flood control. Since the major cause of land loss is lack of sediment, a new and primary function of the River–sediment movement–must be recognized.

Economics dictates that sediment movement can be most feasibly accomplished by directing the flow of the Mississippi River and its distributaries to effect the maximum distribution at the least cost. This means viewing the Mississippi's water as a delivery system, spreading the waters, to the maximum extent, across the deltaic plain, and perhaps beyond, in addition to using as many conduits as possible to move the water (containing sediment and nutrients) into the wetlands.

The approach suggested here involves a reorientation of present goals to allow the maximum consideration to allocating Mississippi River water for wetland restoration. A new goal structure is suggested below.

GOAL: To manage the lower Mississippi River in a manner designed to reverse loss of coastal wetlands of south Louisiana while retaining navigation and flood control.

POLICY: Use the waters, sediment and nutrients of the Mississippi River in a constructive manner to replenish and nourish the wetlands of south Louisiana.

STRATEGY: Provide maximum distribution of the waters of the Mississippi River across the deltaic plain by using the maximum number of distribution points to move water sediment and nutrients into the coastal wetlands.

TACTICS:

1. Implement a phased diversion of Mississippi River waters into the Atchafalaya River on a 2%/yr basis until 50% is reached (10 years) and carefully monitor results. Increase percentage flow to the Atchafalaya River if results are positive.
2. Use spring flood pulse of the rivers to inundate wetlands as the major sedimentation event of each year.
3. Use former distributaries of the Mississippi River to move water and sediments into the deltaic plain wetlands. Bayous Lafourche, Barataria/Grande Cheniere, Grand Liard, and existing spillways are suggested.
4. Move navigation traffic out of the lower Mississippi River above Head of Passes and allow the bedload to distribute naturally across the lower Balize, Barataria, and St. Bernard deltas.
5. Use low level sills in the lower Mississippi levees to move spring flood waters into adjacent wetlands.
6. Use the Atchafalaya's bedload to increase the building rate in the Atchafalaya Bay, while maintaining a navigation channel in

a location deemed more optimal for sediment distribution and delta growth.
7. Create many small diversions from these main channels to efficiently move water into the sinking wetlands.
8. Use canal acreage reduction, marsh management, barrier island restoration, and regulatory approaches to complement and increase the effectiveness of diversions.
9. Use man-made waterways, such as the Gulf Intracoastal Waterway, as lateral channels to move water across basins and interbasins.
10. Implement the authorized and planned U.S. Army Corps of Engineers diversions.

The tactics listed above are not necessarily new, and many of them have been suggested before (Day and Craig, 1982; Gagliano, 1973; Gagliano and Van Beek, 1975, 1976; Gagliano et al., 1981; Houck, 1983; Kolb, 1980; Meyer-Arendt and Templet, 1983; Turner et al., 1982; Van Beek and Meyer-Arendt, 1982; Van Beek et al., 1982; Viosca, 1927). However, little has been done because of current Federal policy. Engineering studies will, of course, provide input to any decision on the mix of alternatives to solve the problem. It is beyond the scope of this paper to be more precise in a description of these tactics.

Conclusion

The wetlands of south Louisiana are being lost and degraded at an enormous and increasing rate. With the loss of these wetlands will go the nation's largest fisheries yield (Turner, 1977) and other immense benefits. The primary cause is a sediment deficit that allows subsidence to dominate the accretion rate of Louisiana marshes. The solution is to provide more sediment to the marshes by allowing the Mississippi River to deliver sediment, while protecting development and navigation. This involves a disaggregated flow regime into more channels, thus allowing a more efficient use of the sediment, nutrients, and water of the Mississippi River.

The keystone of the approach is diversion of more of the Mississippi's water into the Atchafalaya River with subsequent downstream diversion of each river's waters into wetlands. This approach, coupled with other diversions, canal limitations, marsh management, regulation, and barrier island nourishment, will retard and possibly reverse the land loss problem of the Mississippi deltaic plain. Implementation of many of these alternatives requires major Congressional policy changes regarding the management of the Mississippi River. The alternative is to continue our current total commitment of the Mississippi River to navigation and flood control and face the consequences for the loss of the most productive wetland system in the United States.

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Modification of Existing Project Authorities

We urge the Congress to include marsh creation, restoration and preservation as a major mission of the Corps of Engineers. The Assistant Secretary of the Army for Civil Works should be required to direct the Corps of Engineers to develop and implement coastal wetland restoration and enhancement projects.

We further urge the Congress to modify specific Sections of the Water Resources Development Act of 1986 as follows:

Section 704. Study of the Corps Capabilities to Conserve Fish and Wildlife.

Congress should amend this section to include "the Secretary is directed to construct marsh creation projects by diverting Mississippi River flow and sediment by means of low crested weirs built into the river's levees below New Orleans. A total of $10,000,000 is appropriated annually for fiscal years 1990, 1991, 1992, 1993 and 1994 to carry out such projects. The exact locations shall be determined in consultation with the appropriate federal and state officials. The non-Federal share of the cost of any project under this section shall be 25 percent."

Section 906. Fish and Wildlife Mitigation.

Congress should amend subsection (f) to include "the Congress considers the enhancement measures carried out as part of the project for Atchafalaya Floodway System, Louisiana and for Mississippi Delta Region, Louisiana to provide benefits that are national for purposes of this section. The Secretary is directed to construct these projects, the first costs of such enhancement projects shall be a Federal cost as provided in Subsection (e)."

Section 907. Benefits and Costs attributable to Environmental Measures. Congress should direct the Secretary to implement this section and ensure that in the economic evaluation "the benefits attributable to measures ... be deemed at least equal to the costs of such measures."

Section 1135. Project Modifications for Improvement of Environment.

Congress should amend this Section to read "The Secretary is directed to develop guidelines for implementing this Section within one-half year from the date of amendment. The authorization for projects constructed under Section 1135 is extended through fiscal year 1994. In the five year period, the Secretary is directed to construct environmental enhancement projects by modifiying the following projects:

(1) Mississippi River and Tributaries Project, LA. (Flood Control Act of 1928). The Secretary is directed to build marsh creation projects that would divert sediment-laden Mississippi and Atchafalaya River waters below the Old River Control Structure into coastal marshes and water bodies, and marsh restoration projects

that would divert fresh water from the Mississippi and Atchafalaya Rivers below the Old River Control Structure into coastal marshes and water bodies. A total of $50,000,000 is appropriated for each of fiscal years 1990, 1991, 1992, 1993, and 1994 to carry out this work;

(2) Mississippi River Ship Channel, Gulf to Baton Rouge, LA Project (Supplemental Appropriation Act for FY 1985, PL 99-88). The Secretary is directed to build marsh creation projects by pumping material dredged from the navigation channel into coastal marshes and water bodies. A total of $25,000,000 is appropriated for each of fiscal years 1990, 1991, 1992, 1993, and 1994 to carry out this work; and

(3) Gulf Intracoastal Waterway, LA Section (River and Harbor Act of 1946). The Secretary is directed to build marsh creation projects by pumping material dredged from the navigation channel into coastal marshes and water bodies, and marsh restoration projects that would divert fresh water from the GIWW into the marshes and water bodies in the vicinity of mile 225. A total of $5,000,000 is appropriated for each of fiscal years 1990, 1991, 1992, 1993, and 1994 to carry out this work."

Section 1155. Lower Mississippi Wetlands.

Congress should amend this Section to read "The Congress finds that Louisiana's coastal marshlands provide benefits that are of national importance but the marshlands are disappearing, and that the Federal flood control and navigation projects on the lower Mississippi River are preventing River water and sediment from nourishing the marshlands. It is in the public interest to enhance the environment by restoring Louisiana's coastal marshes. Such environmental improvements are deemed to be a co-equal purpose with the flood control and navigation projects on the lower Mississippi River. The non-Federal share of the cost of enhancement projects constructed under this section shall be 25 percent, except where such projects affect publicly owned wildlife refuges, in such cases the first cost shall be all Federal. The authorization for projects constructed under Section 1155 is extended through fiscal year 1994. In the five year period, the Secretary is directed to construct environmental enhancement projects by modifying the following projects:

(1) Mississippi River and Tributaries Project, LA. (Flood Control Act of 1928). The Secretary is directed to implement a program of marsh creation projects that would use low crested-weirs to divert sediment-laden Mississippi and Atchafalaya River waters below the Old River Control Structure into coastal marshes and water bodies, and marsh restoration projects that would use control structures to divert fresh water from the Mississippi and Atchafalaya Rivers below the Old River Control Structure into coastal marshes and water bodies. $30,000,000 is authorized to be appropriated for each of fiscal years 1990, 1991, 1992, 1993 and 1994 to carry out this work;

(2) Mississippi River Ship Channel, Gulf to Baton Rouge, LA Project (Supplemental Appropriation Act for FY 1985, PL 99-88). The Secretary is directed to build marsh creation projects by pumping material dredged from the navigation channel into coastal marshes and water bodies. $15,000,000 is authorized to be appropriated for each of fiscal years 1990, 1991, 1992, 1993 and 1994 to carry out this work; and

(3) Gulf Intracoastal Waterway, LA Section (River and Harbor Act of 1946). The Secretary is directed to build marsh creation projects by pumping material dredged from the navigation channel into coastal marshes and water bodies, and marsh restoration projects that would divert fresh water from the GIWW into the marshes and water bodies in the vicinity of mile 225. $5,000,000 is authorized to be appropriated for each of fiscal years 1990, 1991, 1992, 1993 and 1994 to carry out this work."

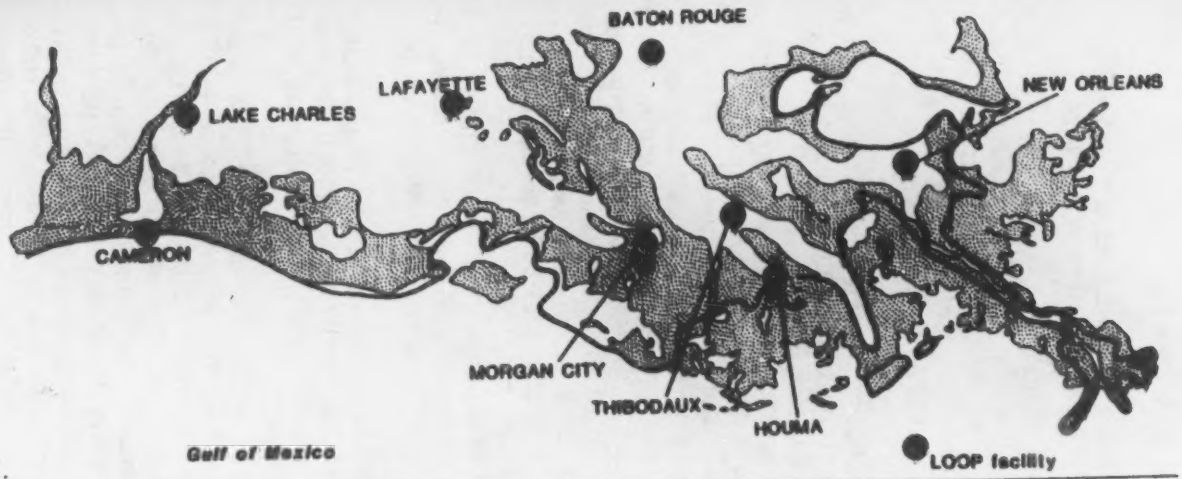

Figure Ca
Louisiana Shoreline in the Year 2030

The CHAIRMAN. Dr. Templet thank you for an excellent statement.

Next we will hear from Colonel Rick Gorski.

STATEMENT OF COL. RICHARD V. GORSKI, NEW ORLEANS DISTRICT ENGINEER, ARMY CORPS OF ENGINEERS

Colonel GORSKI. Mr. Chairman, thank you. I am Colonel Rick Gorski, New Orleans District Engineer for the Army Corps of Engineers. I am delighted to be here to update you today on our activities in coastal Louisiana. And with your permission I will summarize my written statement with short referral remarks.

The CHAIRMAN. Yes, please.

Colonel GORSKI. My remarks supplement the statement of the Honorable Robert W. Page, Assistant Secretary of the Army for Civil Works, presented to you on July 24, 1989.

We have in the Corps a very experienced knowledgeable organization for planning, designing, and constructing wetlands projects for preservation, restoration, and enhancement. Our past planning efforts are paying off now. For example, over the last 15 years in our operating and maintenance mission, we've been using shoal material dredged during maintenance of seven of our navigation channels to create some 3,000 acres of marsh within our existing budget authorities. We're now working on three freshwater diversion projects which will help preserve about 110,000 acres of marsh and wooded wetlands in coastal Louisiana.

The first diversion project at Caernarvon is already under construction. This project will preserve some 16,000 acres of marsh in the Breton Sound Basin. The State of Louisiana is sharing 25 percent of the cost of this project.

The second project in Davis Pond is in the advanced engineering and design process. This project will preserve some 83,000 acres of marsh in the Barataria Basin. We also expect that Louisiana will share in the cost of building this project.

We're continuing engineering and design on the third diversion project at Bonnet Carré. This project will preserve some 10,000 acres of wetlands in the Lake Pontchartrain Basin and in Mississippi Sound. The States of Louisiana and Mississippi support this project. The Administration has stated that this project would be supported on the basis of a 25 percent non-Federal and 75 percent Federal sharing of the project's construction, operation, and maintenance costs. The State of Mississippi has already authorized funds for its share of the project in anticipation that the project will be able to start in 1990 and that the required non-Federal share will be 25 percent.

At Grand Isle we have a project to stabilize Grand Isle's seven and one-half mile Gulf shoreline and provide protection from hurricane waves to this valuable barrier island. We've already spent some $13 million there and over the next few years we'll spend another $15 million.

We're using innovative construction techniques for projects that have to be built in or near fragile wetlands. Geotextile fabrics used to form the foundation of levees greatly reduced the size of the levees and the area of marsh impacted. In the New Orleans to

Venice Hurricane Protection Levee, for example, we were able to save some 4,000 acres of marsh using this construction technique.

To continue the attack on the wetlands loss problem, we do need to develop a bold strategy. When I say we, I mean not only the Corps, the Federal government, but state and local agencies as well. The Louisiana Comprehensive Coastal Wetlands Study could be one blueprint for this strategy. We are working with full partnership with the State on this effort. This effort involves the Corps, the State of Louisiana, the Environmental Protection Agency, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the Minerals Management Service, the U.S. Geological Survey, and the Soil Conservation Service.

I am truly excited about this opportunity this study gives us to cooperate with the State and with other Federal agencies in developing an urgently needed comprehensive wetlands plan for the critical national problem of coastal wetlands loss in Louisiana. The plan will have two parts: site-specific wetlands projects and recommended revisions to Federal, state, and local wetland regulatory statutes, policies, regulations, and administrative procedures.

We will begin to develop the plan early in the next fiscal year once we have Washington level approval to proceed. We expect to submit a final report to my Division Engineer in October of 1992. Louisiana has already indicated their intent to share half the cost of developing this plan, a total cost of $2.4 million. We feel the partnership between the Corps and the State will insure that both parties participate fully in the study management plan, in formulation, in the technical analyses, in the public involvement, and other study tasks.

We also have four other studies under way which address wetlands preservation, restoration, and enhancement. The Land Loss and Marsh Creation Study is identifying economically justifiable ways to create marsh. We're evaluating two basic approaches: using dredged material which is not now used for that purpose and diverting sediment from the Mississippi River. The cost of this study is also being shared between the Federal government and the State of Louisiana on a 50–50 basis.

In the Atchafalaya Basin Water and Land Resources Study, we are developing a multi-purpose delta management plan for the Atchafalaya Bay. Under this plan, over 5,000 acres of marsh could be preserved and created through freshwater diversion and the management of sediments in the actively growing delta in the Bay.

Under the Mississippi River-Gulf Outlet Project, we're studying shoreline protection features that will preserve some 1,700 acres of marsh from erosion.

In the Grand and White Lakes Study we're looking at enhancing fish and wildlife habitat in a way that's compatible with navigation, flood control and other uses.

The New Orleans District of the Corps has one of the largest regulatory programs of any Corps District. As you know, this program was set up to avoid indiscriminate and unwise development in wetlands. The decision whether to issue a permit is based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest.

I would point out that under Section 401 of the Clean Water Act and Section 307 of the Coastal Zone Management Act, the State of Louisiana can exert a great deal of influence regarding which Corps permits are denied and regarding what conditions are placed on those Corps permits which are issued.

We like to think the Corps is a "can do 'organization. We have been, and continue to be actively involved in planning, designing and constructing wetlands preservation, restoration and enhancement projects. We pride ourselves in the ability to convert ideas into action and action into progress.

In the wetlands arena we recognize that other agencies have responsibilities and expertise and that an effective wetlands program must be a unified interagency effort. We see ourselves as a principal technical support agency, a builder, a regulator, along with other Federal agencies. We stand ready to work with other Federal and state agencies to accomplish whatever environmental engineering tasks the Congress and the Administration may deem appropriate.

Mr. Chairman, this concludes my statement.

[The prepared statement of Colonel Gorski follows:]

U.S. ARMY CORPS OF ENGINEERS

NEW ORLEANS DISTRICT

COMPLETE STATEMENT OF

COLONEL RICHARD V. GORSKI

BEFORE THE

SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES

Mr. Chairman and members of the Committee, I am Colonel Richard V. Gorski, the U.S. Army Corps of Engineers, New Orleans District Engineer. I am pleased to be here to tell you of our activities within coastal Louisiana. My statement will supplement the statement presented by the Honorable Robert W. Page, Assistant Secretary of the Army for Civil Works, before you on July 24, 1989.

As you requested, I will focus on specific measures and projects concerning our wetlands loss problem. I will discuss what we have done, what we are now doing, and what can be done under existing authorities and Army policies. I will also identify how we visualize our future role in restoring, preserving and enhancing wetlands in Louisiana.

Wetlands cover much of the New Orleans District, and thus, are involved in nearly every aspect of our mission. Although the Corps has no single purpose mission for wetlands preservation and enhancement, we have been implementing such measures through multipurpose authorities for flood control and navigation. We now have in-place an experienced and knowledgeable organization that has planned, designed, and constructed wetland preservation and enhancement measures.

In all of our activities, we strive for engineering solutions that are environmentally sound. Environmental concern is first evidenced in our planning program, where projects are designed to avoid environmentally sensitive areas. Where avoidance is not possible, we design the project to reduce environmental impacts. Then, we include additional features in the

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project to offset or mitigate any environmental losses. During construction, our inspectors monitor activities to insure that environmental restrictions are adhered to. In our dredging program, we, along with the U.S. Fish and Wildlife Service, the Environmental Protection Agency, the National Marine Fisheries Service, and the Louisiana Department of Wildlife and Fisheries , conduct in-field inspections of possible disposal sites to make certain the projects are maintained in an environmentally sensitive fashion.

WHAT WE HAVE DONE

Beneficial Use of Dredged Material. We are using shoal material dredged during maintenance of seven of our navigation channels in a manner conducive to the creation of marsh. In the last 15 years, we have created 3,000 acres of marsh in this manner. Marsh creation is part of the following ongoing Operation & Maintenance dredging projects:

- o Barataria Bay Waterway, Louisiana
- o Gulf Intracoastal Waterway (GIWW)
- o Mermentau River, Louisiana
- o Mississippi River-Gulf Outlet (MR-GO)
- o Mississippi River; Outlets at Venice, Louisiana
- o Calcasieu River and Pass, Louisiana
- o Atchafalaya River and Bayous Chene, Boeuf and Black, Louisiana

Shoreline Protection. The purpose of the Grand Isle and Vicinity, Louisiana, (Hurricane and Shore Protection) project is to stabilize Grand Isle's 7.5 mile Gulf shore and provide protection from Gulf waves generated by hurricanes.

Construction Techniques. Geotextiles are proving invaluable in our levee work. The geotextile fabric is used to reinforce the levee foundation and support the embankment load. This greatly reduces the size of the levee, minimizing the real estate, largely marshland, required. One example is the present construction of a 13-mile section of the New Orleans to Venice hurricane protection levee in Plaquemines Parish in which we are using about 470,000 square yards. On this one levee the reduction in marshland required is 4,000 acres.

WHAT WE ARE NOW DOING

Freshwater Diversion. Three projects to reduce saltwater intrusion and improve fish and wildlife habitat and productivity in the marshes adjacent to the Mississippi River are in advance stages of implementation. These projects will preserve 110,000 acres of marsh and wooded wetlands. Information on these projects follows:

Construction has begun on the Caernarvon Freshwater Diversion Structure, a feature of the authorized Mississippi Delta Region Project, which will preserve and enhance 16,000 acres of marsh and produce an average annual increase in commercial fish and wildlife production of $6,700,000 within the Breton Sound Basin over the 50-year project life. The State of Louisiana and the Corps are sharing the cost of this project on a 25/75 percent basis.

Advanced engineering and design is underway on the Davis Pond Freshwater Diversion structure, also a feature of the authorized Mississippi Delta Region Project. This project will preserve 83,000 acres of marsh and produce an average annual increase in commercial fish and wildlife production of $10,900,000 within the Barataria Basin over a 50-year project life. We anticipate the State of Louisiana will share in the cost of this project.

Preconstruction engineering and design is continuing on the Bonnet Carre' Freshwater Diversion Structure. This diversion project will preserve 10,500 acres of marsh and swamp and produce an average annual increase in commercial fisheries production of national significance of $7,900,000 within the Lake Pontchartrain Basin and the western Mississippi Sound over the 50-year project life. The States of Louisiana and Mississippi support this project. The State of Mississippi has authorized funds for its share of the project in anticipation that the project will be able to start in 1990 and that the required non-Federal share will be 25 percent. In this connection, the Administration has stated that this project would be supported on the basis of a 25 percent non-Federal and a 75 percent Federal sharing of the project's construction, operation and maintenance costs.

Wetlands Management. Under the Atchafalaya Basin Floodway System Project, we are acquiring environmental protection easements. These

easements will be acquired for 365,000 acres of predominately bottomland hardwood forest. These environmental protection easements prohibit the conversion or development of lands from existing uses to other uses such as clearing for agriculture and/or industrial development. The easements allow prudent and customary silvicultural practices; however, clear cutting is prohibited without written approval from the Corps.

WHAT WE ARE NOW STUDYING

Comprehensive Wetlands Plan. One of the major hindrances to making any real inroads into solving the coastal erosion problems in the New Orleans District is the lack of an overall plan. Throughout the coastal area Federal, state, and local governmental agencies, commercial and corporate entities and individuals are all addressing aspects of the problem that are of special concern to them. Unfortunately, not only do these individual actions not work synergistically, they often work at cross purposes. We are excited about an opportunity that we have in New Orleans to do something about this. That opportunity is our Louisiana Comprehensive Coastal Wetlands study.

The study is in the reconnaissance phase and has as its purpose to define how various wetland preservation, restoration, and enhancement projects will be identified or formulated and then integrated into a Comprehensive Plan to address the National problem of wetland loss in coastal Louisiana. Upon approval of the reconnaissance study, the feasibility phase will be initiated. It is scheduled to start in early Fiscal Year 1990 and be completed with submission of a final report to the Division Engineer in October 1992.

Federal participants in the study with the Corps include the Environmental Protection Agency, the Fish and Wildlife Service, the Geological Survey, the Minerals Management Service, the National Marine Fisheries Service , and the Soil Conservation Service. State of Louisiana participants include the Department of Environmental Quality, the Department of Natural Resources who is also the local cost-sharing sponsor for the study, the Department of Transportation and Development and the Department of Wildlife and Fisheries. The feasibility phase will be cost shared by the State of Louisiana on a 50-50 basis.

The "Comprehensive Wetlands Plan" final product will be composed of site-specific wetland preservation, restoration, and enhancement projects of the following types:

- o Beneficial use of dredged material.
- o Sediment diversion.
- o Freshwater diversion.
- o Shoreline protection.
- o Wetland management (water-level and salinity manipulation).
- o Vegetative plantings.
- o Canal modification.

The **Louisiana Coastal Area, Land Loss and Marsh Creation Study**, presently in the feasibility phase, is considering the advisability of creating marsh with dredged material not presently used for that purpose, and diversions of sediment. The feasibility study is scheduled for completion in July 1992. The study is being cost shared, on a 50% Federal and 50% local sponsor basis, with the Louisiana Department of Natural Resources. Individual reports will address land loss problems and marsh creation opportunities in three separate study areas: St. Bernard, Plaquemines, and Jefferson Parishes; Terrebonne and Lafourche Parishes; and Cameron, Vermilion, Iberia, and St. Mary Parishes. The draft feasibility report for the St. Bernard, Plaquemines, and Jefferson Parishes study area will be completed in early FY 1990. Work is scheduled to begin on the Terrebonne and Lafourche Parishes study area in early FY 1990.

The **Atchafalaya Basin Water and Land Resources Study** is in the feasibility phase. Its purpose is to develop a comprehensive multi-purpose plan which encompasses flood control, navigation, environmental protection and enhancement and recreation for the Atchafalaya Basin Floodway System. The Delta Management study is investigating alternatives to optimize the development of marsh with the actively growing Atchafalaya Delta, while maintaining the navigation and flood control features of the Atchafalaya River. The Avoca Island Levee extension reevaluation is considering freshwater diversion into Avoca Lake. This diversion may result in the creation of 5,000 acres of marsh.

Under the **Mississippi River - Gulf Outlet project**, shoreline protection features are being considered that would reduce the projected dramatic increases in shoaling rates and protect 1,700 acres of marsh

from erosion over the 50-year project life.

The **Grand and White Lakes Study** is in the feasibility phase. Its purpose is to investigate the operation of the Grand and White Lakes system in southwest Louisiana to enhance flood control, irrigation, fish and wildlife habitat and production, navigation and recreation. We recently agreed to modify the operation of the Catfish Point Control Structure in that system at the request of the State of Louisiana. This modified operation, accomplished in May-July 1989 and scheduled again in May-July 1990, will benefit migrating marine organisms and not affect lake levels. The data collected during these operations will be incorporated in the Grand and White Lakes study schedule for completion in FY 91.

CORPS REGULATORY PROGRAM

The New Orleans District has one of the largest regulatory programs of any District in the Corps. The vast majority of development activities which could adversely affect Louisiana's coastal wetlands (activities such as dredging, filling, building of structures, etc.) require a permit from the Corps under Section 10 of the Rivers and Harbors Act of 1899, and/or Section 404 of the Clean Water Act. The decision whether to issue a permit is based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest. In addition, no 404 permit is issued unless compliance is demonstrated with EPA's Section 404(b)(1) guidelines.

It is important to note that, under the existing Federal law, the State of Louisiana can exert a great deal of influence regarding which Corps permits are denied, and regarding what conditions are placed on those Corps permits which are issued. For example, under Section 401 of the Clean Water Act (CWA), the Corps will deny any permit which could involve a discharge (e.g., any 404 permit) if Louisiana denies the Section 401 water quality certification. Similarly, the state can impose practically any permit condition it wants to under CWA Section 401(d). As EPA has pointed out in its publication, Wetlands and 401 Certification, in April of 1989, 401 can be used effectively by a state to protect wetlands, if the state so chooses. In addition, under Section 307(c)(3) of the Coastal Zone Management Act (CZMA), the State of Louisiana has a

second "veto" authority over Corps Section 404 permits. Louisiana can use its CZMA authority to require denial of Corps permits, or to convince the applicant to modify his project (through permit conditions or otherwise) so as to avoid the state's CZMA "veto".

Along with the Corps, three other Federal agencies have a role in delineating wetlands: the EPA for its Section 404 and Section 402 programs, the Soil Conservation Service for its Swampbusters program and the Fish and Wildlife Service for its inventory and acquisition programs.

Under the Louisiana Comprehensive Coastal Wetlands Study, we will examine existing wetland regulatory statutes, policies, regulations, and administrative procedures that would contribute to the preservation, restoration, and enhancement of wetlands.

CONCLUSION

The Corps is a "CAN DO" organization. We have been, and continue to be, actively involved in constructing, designing, and planning wetland preservation, enhancement and creation projects. We pride ourselves in our ability to convert ideas to action and action to progress. In the area of wetland protection we recognize that other agencies have responsibilities and expertise and that an effective wetlands protection program must be a unified interagency effort. We see ourselves as a principal technical support agency, a builder, a regulator. Through our staff of engineering and environmental professionals we bring engineering solutions to wetland loss problems. Our decentralized organization puts our people in the field, where the action is. Our Comprehensive Coastal study has shown us that the several Federal and state agencies involved in the wetland arena can work together productively. We in the Corps of Engineers stand ready to accomplish whatever environmental engineering tasks the Congress and the administration deem appropriate.

Mr. Chairman, that concludes my statement. I would be pleased to address any questions you or other members of the committee may have.

The CHAIRMAN. Thank you very much, Colonel Gorski; an excellent statement.

Next, we will hear from Ms. Virginia Van Sickle who is Secretary of the Louisiana Department of Wildlife and Fisheries.

STATEMENT OF VIRGINIA VAN SICKLE, SECRETARY, LOUISIANA DEPARTMENT OF WILDLIFE AND FISHERIES

Ms. VAN SICKLE. Senator Johnston, my name again is Virginia Van Sickle and I am Secretary of the Department of Wildlife and Fisheries. In my written testimony, which we'll have 60 copies, consists of two parts.

First is a description of the wetland loss problem and what you've all heard about many times. But I took your letter seriously when you talked about solutions and wanting to not just concentrate on the issue, but on real solutions; because I was testifying in Congress last month before another committee and some members of the delegation feel that there's not much that can be done. There are a lot of things that can be done other than freshwater diversions and my Department, with the U.S. Fish and Wildlife Service, has been actively involved in managing wetlands for over 50 years. We have over 500,000 acres of coastal wetlands currently under intensive management. We only have three million acres of wetlands in the coastal zone that are left. That's 41 percent of this country's coastal wetlands, and while we have 41 percent of the coastal wetlands, (as Paul said) we have 80 percent of the coastal wetland loss occurring in Louisiana.

So if I could just project this up on the wall here and show you some of the solutions that we found to work at the Department of Wildlife and Fisheries in summary form.

Of course the most commonly accepted solution that each of the speakers has addressed before me is just mimicking nature by introducing freshwater sediment into the coastal wetlands. To understand how this works, of course you need to know that the coast is formed of a series of barrier island chains and deltaic forms that are eroded as the Mississippi River changes course. The River has changed course to the Gulf of Mexico seven times over the past 8,000 years. Each time it changed course to the Gulf of Mexico it builds a deltaic load in one area, while it abandoned the deltaic load in another area, and then that part of the coast started to deteriorate.

The slide here just shows the areas that are deteriorating the fastest and, as you can see, the areas in red are losing acreage up to 40 square miles per year.

The most commonly accepted approach is just to mimic nature by encouraging the seasonal overbank flooding that the River is prone to do on a natural geologic basis as it built wetlands in our coast over the past 7,000 years. As we've levied the Mississippi River, we've prevented this seasonal overbank flooding in the deposition of sediment that is shown on this slide as it's suspended in the water and creating a turbid effect that's picked up in the aerial entry.

Freshwater diversions can be very inexpensive. We've got three going on right now sponsored by the State in Pass a Loutre. All

three of these together only cost $225,000 to complete. On the other hand, you've got structures like the Old River control structure and the Caernarvon structure which is currently being constructed by the Corps of Engineers that will cost upwards of $25 million to $30 million. So there are inexpensive freshwater diversions and there are expensive ones.

Again, the prime purpose of a freshwater diversion and a sediment diversion is to keep the Mississippi River from dumping its load of precious silt, sands, clays and freshwater off the continental shelf into the deep waters of the Gulf of Mexico.

Another way to get sediment into the marsh is to use the Corps of Engineers maintenance dredging operations where they dredge out the water bodies and the channels for navigation purposes to create marsh.

This is a slide that I got from the Corps of Engineers showing the Lake Calcasieu area, the Calcasieu River, where they're using dredge spoil to create marsh.

This is a pipeline canal that was dredged to support offshore oil and gas development. Again, rather than piling this sediment up on either side of the canal, the sediment could be dispersed (like was shown in the previous slide) like the Corps is using, to create marsh; not just pile it up in a levee form on either side.

Sand fencing is another commonly used, widely accepted practice that will retard erosion on barrier islands. It's very inexpensive and it works. Sand fencing in areas like the new Atchafalaya delta, which has been building up since the floods in 1973 and 1975, can be used to trap sediment in the growing delta by slowing the water movement down so that the sediment actually precipitates out of the water column, creating marsh. This is the perfect place to try the use of sediment fencing.

Another way to get sediment into the system is through barrier island restoration. This is pretty much the way our barrier islands look in a graphic sense. You've got pipeline canals going across from storm breeches and channels being dredged through them for oil and gas development and other purposes. What you can do is come in and put sediment on the barrier island, build a shoreline out, start to restore the dunes, and then come back in with a series of vegetation plantings that serve to hold the sand on the barrier island and keep it in place.

Again, this is a commonly accepted practice that has been used on the east coast. In Florida the Corps of Engineers has dredged sand 18 miles offshore and pumped it onto the Florida coastline to prevent their barrier islands from eroding.

The barrier islands in Louisiana have lost over 60 percent of their land mass since the late 1800's. This is the barrier island chain off of the Terrebonne coast just to show you what deterioration means to the wetlands behind them as well.

Barrier island restoration is expensive. This is an estimate of what it would cost to restore the barrier islands in millions of dollars from Plaquemines Parish all the way over to the southwest Terrebonne marsh.

The CHAIRMAN. Where did that estimate come from?

Ms. VAN SICKLE. This came from the coastal protection program n the division in the Department of Natural Resources.

This is basically the dredged up sand bodies that are in the offshore area that are old relic deltaic features themselves and pump the sand on the barrier islands—putting sand into the system at strategic locations where it will lengthen the life span to this island.

Another commonly accepted practice that the Corps is very experienced in is just the use of seawalls and t-groins and that sort of thing. Rip-rap along the coast where you've got a very expensive facility to protect like a highway may be the only answer. In general terms most of the scientists and the technical people that have been involved in this issue prefer the soft approach, or the sediment nourishment approach, to the use of rip-rap because one good hurricane can destroy that and no sand is left in the system to be carried downdrift by the current.

Another place you might want to use hard structure is to protect an expensive oil and gas refinery like this facility down in the Fourchon area where you can't let the shoreline just erode and do its natural thing. You have to protect some of these facilities that are a large investment and important to the country.

Two areas that we have residential development abutting the coastline are Grand Isle and Holly Beach. This is another area where t-groins or jetties or seawalls might be appropriate.

There is another whole realm of coastal protection solutions that fall into the category we call wetland conservation practices or marsh management practices. This is the simplest form of marsh management. It is called the Wakefield Weir. Basically it's a fixed sill that is constructed in either a natural bayou or canal that keeps the wetland from being inundated with saltwater and destroying the brackish and fresh marsh vegetation that can be killed if the saltier Gulf water keeps intruding further and further north as it is.

Another sort of water control structure is a reverse operated flat-gate structure like this one on Rockefeller Refuge where we can let the water into the marsh so that the marine organisms can get in and mature, and then we can let them out of the marsh through this particular structure here. This one cost about $75,000.

This is another more sophisticated structure on Rockefeller Refuge. This is called a stop-log structure and as you can see it cost a lot more to build something like this. It costs roughly $250,000 to build an expensive water level management structure like this. Water level management is not just used by Rockefeller Refuge staff and the staffers at the Sabine National Refuge and our agency. This is the approach that landowners most often turn to because it is so inexpensive. Again, the prime purpose of this sort of structure and this strategy is to prevent saltwater from getting into that fresh and brackish wetland and destroying the plants.

The use of water level control structures too, is frequently implemented so that we can drain the marsh and encourage the germination of your seeds for your marsh grasses. As a result of the intensive management in southwest Louisiana, we harbor roughly one-sixth of the nation's waterfowl each winter; in just three parishes, Calcasieu, Cameron and Vermillion Parishes, alone.

Another thing you can do is you can plant salt-tolerant marsh grasses. The Soil Conservation Service has a plant materials labo-

ratory they've just built down along the western border of Bayou Lafourche where they are developing salt-tolerant strains of marsh grasses that can be introduced in two wetlands that are eroding and deteriorating as a result of saltwater intrusion.

Another thing you can do is you can plant dune vegetation to stabilize your barrier islands which, of course, are barriers protecting the wetlands from the erosional forces of the sea and from saltwater.

Another common practice is marsh burning. This is a practice that is 60 or 70 years old (at least) and the impact of this particular management measure is to increase the primary productivity of the wetland; increase the bio-mass production, and to encourage the establishment of plant species that are favorable to fur bearers and waterfowl production. It's basically like pruning the plants, and if it's done during September to January where there's a lot of soil moisture, you won't damage the root system. You will encourage, on the other hand, (double in some cases) the amount of growth that you might get in that particular marsh.

Sealevel rise is something that's occurring on a global basis. You're all aware of that. The sealevel rise in Florida, you'll see, is roughly one-fifth of the relative sealevel rise that we have in Louisiana. That is because our tide gauges are sinking. The Gulf of Mexico is rising on the average of one-fifth of a centimeter per year. This is global sealevel rise. In addition to that, our sediments are compacting in Terrebonne wetlands, Lafourche wetlands, Plaquemine Parish, St. Bernard Parish, at four-fifths of a centimeter per year. So you put that together and the relative sealevel rise in Louisiana is a full one centimeter. Roughly a half inch per year.

So the global sealevel rise is something you can, maybe all the countries together could do something about. But we feel like we have very little control over that here in Louisiana.

Something a lot more localized that we can control are the overpopulation of fur bearers. This is a muskrat "eatout" in a brackish marsh. Take a little closer look and you can see the muskrat houses and the vegetation has literally been eaten out and they even get down into the root system and destroy the wetlands. Rather than that vegetation just coming back as the wetlands are being inundated with salty Gulf water and their sinking, they don't have a chance to reestablish themselves and they generally turn to open water when you have something like this occur.

Another case, and this is a nutria "eatout" in fresh marsh, and again, these can be very damaging to the marsh. So we've got global problems and we've got very localized problems for which there are solutions. A solution to the nutria and muskrat problem is simply trapping. The anti-trapping sentiment that has taken over in Europe and now the United States, has caused a depression in our fur market. Nutria pelts were $8 a piece just in 1980, and now we can't sell them for more than $1. So these animals are overpopulated and when we had the fur population under control, we literally sold 6,000 trapping licenses. Now we have less than 1,000 trappers.

Some of the most obvious things that we can do as solutions that are some of the most difficult because they impact both economic growth and energy supply, is we can stop doing some of the most

damaging things that we've done to our wetlands. Most blatant being canal dredging, pipeline dredging, that sort of thing. In addition to the direct dredging up of the marsh, we discharge almost a billion barrels of brine into our wetlands each year. This brine, (in some cases five to eight times more salty than seawater) and it's just being discharged directly into water bodies that are two and three feet deep. The saltwater intrusion from the Gulf is nothing compared to the salinities that we get from the produced water. Do you know that one-fourth to one-third of the produced water that's being discharged into our wetlands comes from the outer continental shelf? It's pumped on shore with the oil and gas products, separated on shore and then discharged into our wetlands, not offshore.

[Advancing slides on projector.]

Navigation channels are another tremendous problem we have. This is the Lake Washington oil field and this is Freeport Canal. Freeport Canal not only services the on shore oil and gas industry, it also is heavily used by the outercontinental shelf oil and gas industry. As you can see we've torn up our coast pretty good in certain locations.

This is a backwards slide of oil and gas leases off the Louisiana coast. The Louisiana outercontinental shelf contributes—is the second largest contributor to the Federal treasury; second only to the IRS combined with the Alcohol/Tobacco Firearms Bureau. We have had 3,600 plus oil and gas wells drilled in our outercontinental shelf zone. In California they've had 17, there's none in Alaska, and in Florida they've had less than a dozen. None of them have discovered oil or gas.

The impact of your legislation, Senator, I see going way beyond just the wetlands issue. We have the greatest liability in the United States for a major oil spill off of our coast. We have the loop pipeline that comes on shore down at the Fourchon area. In March, for example, the loop pipeline transported 30 million barrels of oil on shore. Put that together with these leases and 3,600 producing platforms and we have a tremendous oil spill liability and exposure here in Louisiana. From a fish and wildlife prospective I think your amendment is very important to the State. Not just from a wetlands standpoint, but from an oil and gas spill or oil spill standpoint as well.

That's all.

[The prepared statement of Ms. Van Sickle follows:]

STATEMENT OF VIRGINIA VAN SICKLE
BEFORE THE SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES

August 31, 1989

Mr. Chairman and members of the Committee, my name is Virginia Van Sickle and I am Secretary of the Louisiana Department of Wildlife and Fisheries. I appreciate the opportunity to appear before you today in support of a very important piece of legislation that will assist in the protection of forty-one percent of this country's coastal wetlands and which will minimize the risk of further coastal destruction which could result from a major oil spill.

Eighty percent of the wetland loss in the United States occurs in Louisiana each year. Roughly one half of Louisiana's coastal wetlands have been lost. This loss is caused by a combination of natural processes (such as sea level rise and subsidence of abandoned delta lobes) and man's interference. The United States Army Corps of Engineers has leveed and channeled the Mississippi River from Cairo, Illinois, to the Gulf of Mexico, preventing natural overbank flooding and sediment deposition required to maintain our coastal marsh. Thousands of miles of oil field canals have directly destroyed our wetlands in support of energy development. The New Orleans office of the Minerals Management Service is the second largest contributor to the U. S. Treasury; the Internal Revenue Service is the single largest contributor. Over eighty percent of United States Outercontinental Shelf production has occurred off our coast and has come onshore through hundreds of pipeline canals and navigation channels. The impact of providing flood control and waterborne commerce for two-

thirds of the United States and for the development of onshore and OCS oil and gas has left our coast in a scarred and deteriorated condition.

The good news is that we still have three million acres of coastal marsh and swamps left in Louisiana. This three million acres comprises forty-one percent of this Nation's coastal wetlands. Further demise of this sediment-starved ecosystem has serious implications for fish and wildlife in much of the United States, not just Louisiana.

Large-scale losses of marsh habitat in the coastal zone are occurring concurrently with declining numbers of waterfowl wintering in our region. Although much of the decrease in waterfowl is attributed to the loss of interior wetlands, waterfowl experts believe that habitat changes in the Gulf Coast will adversely affect the number of waterfowl surviving through the winter and their subsequent reproductive success. There is good reason for concern.

The number of ducks (mallards, pintails, canvasbacks, teals, and other major species) wintering in coastal Louisiana has declined from an average of 4.6 million in the early 1970's to less than 2.8 million...a loss of almost one half of our migratory waterfowl.

Louisiana marshes still support more waterfowl than any other state, including one-fourth of North America's entire duck population and over two-thirds of the duck population for the productive Mississippi Flyway.

Louisiana wetlands also support this country's largest population of fur-bearing animals. We rank first in United States fur production and first in North America.

Our coastal ecosystem is made up of forested wetlands, marsh, barrier islands, and open water. Between the marsh interface and the barrier

islands lies the most productive estuary in the country. The productivity of this system is largely due to primary (photosynthetic) production of our marshes.

Louisiana leads the Nation in the production of seafood, with an average of thirty percent of United States landings annually. We are the top producer of shrimp, menhaden, oysters, and crabs. Our shrimp fishery is valued at an average of $200,000,000 per year dockside. Last year we produced a record 53,600,000 pounds of crabs (one-quarter of United States crab production).

Fishery production in the Gulf of Mexico is heavily dependent upon the estuary/marsh complex of south Louisiana. These fishery nursery grounds support fishery harvests from Texas to Florida.

The National Marine Fisheries Service has just published several papers which present the alarming theory that once the marsh fraction of our coastal ecosystem begin to decline. NMFS asserts that the continual conversion of marsh to open water will have a peak or optimum effect on fisheries and then decline dramatically. Scientists at Louisiana State University and NMFS predict a "collapse" of our fisheries within thirty years if the trend in marsh loss is not reversed.

We can restore wetlands. Over 500,000 acres of Louisiana coastal marsh are actively managed by our Department of Wildlife and Fisheries and the United States Fish and Wildlife Service. We have virtually eliminated wetland loss in managed areas such as Rockefeller Refuge and Marsh Island.

We can slow the unique rate of wetland loss which is occurring in Louisiana. The wetland loss problem in the Mississippi deltaic plain is well documented and, while we don't have all of the answers, there are

proven techniques which can be implemented to reduce the current rate of shoreline erosion and marsh deterioration.

The most widely accepted solution is both the simplest and the most expensive. It involves the introduction of fresh water and sediment from the Mississippi River into wetlands which flank the main channel. Using existing waterways it is also possible to direct a portion of the sediment and fresh water into older Mississippi River distributaries to the east and the west of the modern delta. By restoring natural depositional processes through fresh water diversions, navigation can be maintained in the existing channel and the precious sediment which once built our coastline will not be lost off the Continental Shelf.

Other practical solutions which involve sediment nourishment include the beneficial uses of dredge spoil, the use of sediment traps, and barrier island restoration. The New Orleans District of the U. S. Army Corps of Engineers dredges more cubic yards of sediment than any other Corps district in the United States. This dredging is conducted to provide navigation and flood control. To this day, the Corps is dumping thousands of tons of dredge spoil offshore and on levees each month as part of their maintenance dredging operations.

Sediment traps vary from common sand fencing and vegetation plantings to more sophisticated methods of slowing water currents, thereby enhancing sediment deposition and retention.

Barrier island nourishment is commonly used in Florida, Mississippi, and many east coast states. The primary objective to this "soft structure" approach is to get coarse-grained sediment into the barrier island system. Research which is nearing completion by the U. S. Geological Survey has

revealed the dynamic nature of Louisiana's barrier islands which protect Louisiana's coastal wetlands. These barrier islands are all erosional features. The Isle Dernieres and chain, for example, represents the remains of the Lafourche delta lobe which was abandoned 400 years ago. The Chandelier Island chain was formed as the St. Bernard delta was abandoned by the Mississippi River over 2000 years B.P. Understanding the geologic processes which dominate the barrier islands off our coast could save the state and federal government millions of dollars. Beach nourishment is expensive and the placement of sand in certain locations would extend the life of the barrier islands. The effects of winds, waves and tides must be factored into any barrier island restoration project.

If the soft approach does not provide the necessary shoreline protection, conventional hard structures such as seawalls and t-groins can be utilized. Again, these types of structures have proven to be effective in other states and would be especially appropriate where protection is needed for highways or other costly facilities, such as an oil and gas refinery.

There are numerous techniques for restoring and protecting wetlands which fall in a category commonly referred to as "marsh management". Much of the 500,000 acres of coastal wetlands which are managed by the U. S. Fish and Wildlife Service and the Louisiana Department of Wildlife and Fisheries are intensively managed using water-level control strtuctures. These structures range from small Wakefield weirs to large stop-log structures and pumping systems.

In some cases the water level is drawn annually down to encourage the germination of marsh plants. In other situations, weirs are used simply to

keep salty Gulf water from intruding into fresh and brackish marshes. These systems work well in the wetlands of Southwestern Louisiana where the topographic relief (i.e. chenier ridges) is parallel to the Gulf shoreline, not perpendicular to it.

The planting of dune vegetation and salt-tolerant marsh grasses in regions of our coast which are deteriorating as a result of salt water intrusion is another means for stabilizing wetlands. The burning of the marsh is an old technique which encourages plant growth, increases biomass production and favors the establishment of plant species preferred by waterfowl and furbearers.

Many other solutions to the wetland loss problem could be discussed today, ranging from the global need for reducing emissions into the atmosphere which are creating the "greenhouse effect" (which is drowning our marshes) to the control of nutria and muskrat that are literally eating up the marsh. The rate of relative sea level rise in Terrebonne and Plaquemines Parishes is roughly 1 cm/year. This is five times greater than relative sea level rise measured in Florida. The reason is that our tide gauges are sinking at the same time that the mean Gulf level is rising 1/5 cm/year.

I mentioned nutria and muskrat; this is a muskrat "eatout". A closer look reveals hundreds of muskrat houses and a marsh which may convert to open water as a result of the over-population of fur-bearers. The solution: trapping.

Numerous other techniques can be used to restore and protect coastal wetlands. Among the hardest to accomplish are those which will impact economic growth and energy supply. The dredging of canals for oil and gas

development, the enlargement of navigation channels for OCS oil and gas development, and the discharge of oil field brines and drilling fluids into coastal wetlands are examples of issues that the state should closely regulate to insure that positive projects in one part of the coast are not offset by destructive projects in another.

The CHAIRMAN. Thank you very much, Ms. Van Sickle. Excellent testimony. Finally, we have Dr. Michael Loden who is the Environmental Director at Jefferson Parish.

STATEMENT OF DR. MICHAEL LODEN, DIRECTOR, JEFFERSON PARISH ENVIRONMENTAL AND DEVELOPMENT CONTROL DEPARTMENT, ON BEHALF OF MIKE YENNI, PARISH PRESIDENT

Dr. LODEN. Senator Johnston, my name is Michael Loden, I'm the Director of the Environmental and Development Control Department of Jefferson Parish. On behalf of Parish President, Mike Yenni, I would like to thank you for the opportunity to provide comments.

The Jefferson Parish lies along the Mississippi River immediately upstream from the City of New Orleans. We extend from Lake Pontchartrain on the north to the Gulf of Mexico on the south. Our population is approximately 500,000 persons and is concentrated within about 20 percent of our Parish. The remaining 80 percent is more sparsely populated and comprises a transition from swamps to fresh, intermediate, brackish, and saline marshes, to the open waters of Barataria Bay and the barrier island of Grand Isle. The economy of our Parish, like so many others in southern Louisiana, depends heavily on water-borne resources including oil and gas activity, commercial and recreational fishing, and transportation.

We have become increasingly, increasingly involved in controlling coastal erosion and promoting wetlands restoration. Jefferson is currently participating with the State on a single project which would help protect the Jean Lafitte National Park, and a Federal commercial waterway, and restore marsh to a relatively extensive area. We are working with the State on another project that would be a wetlands education project. Other projects being developed include an erosion protection and marsh restoration exercise near the town of Jean Lafitte; erosion protection in the Bayou Barataria segment of the Intracoastal Waterway; stabilization and restoration of the only known brown pelican nesting area in Louisiana west of the Mississippi River; and, marsh development along the south shore of Lake Pontchartrain.

Money for the Parish share of these projects is from a dedicated source of revenue. The Jean Lafitte National Historical Park provides payment to Jefferson Parish in lieu of the ad valorum taxes that would have been paid had the property remained in private hands. These payments are placed into a "Mitigation Fund" which whose total now exceeds $250,000. This money is available to us in the Parish for wetlands projects if the Fish and Wildlife Service designates a project as mitigation for public works projects that we do farther to the north.

Now State and Federal agencies have spent many millions of dollars in efforts to restore the integrity of Grand Isle. I think the total, if my addition was right, was somewhere around $28 million thus far earmarked for essentially beach restoration. These efforts by the Federal government and the State are welcome not only to protect the residents of Grand Isle, but also to maintain the island's effectiveness as a barrier to saltwater intrusion coming into the Barataria Estuary.

Now we believe that a less expensive, more effective method of barrier island protection should be examined. We feel that the source of sand comprising the barrier islands in our area was sediment transported by the Mississippi River. Since the completion of the Southwest Pass of the Mississippi River in the 1950's, this sediment (as has been mentioned earlier) has been channeled off the continental shelf and into the depths of the Gulf of Mexico. Longtime residents of Grand Isle have related to me that while beach erosion is not new, the fact that the beach does not restore itself (that is, does not replenish itself) has only occurred since the completion of Southwest Pass. The old-timers say that the beach has washed all the way back to the road on a number of occasions, but in the ensuing years, it has built itself back up to its previous location.

We feel that the Federal government should consider installing major sediment diversions or distributaries along the lower reach of the Mississippi River on the continental shelf. These would create mixing zones of fresh and saltwater nearer to shore, thereby reducing rapid salinity fluctuations that occur in the marsh; it would provide a source of sediments for the natural replenishment of barrier islands; and, create highly productive new marshes for seafood harvesting. Because the diversion of sediments off the continental shelf to maintain open channels directly benefits the commercial shipping industry, at the expense of wetlands, we feel that perhaps the costs of evaluation and possible development and management of sediment diversions could be shared, at least in part, by the commercial shipping industry We believe that the Mississippi River sediments are a natural resource and that this resource should be utilized and managed rather than discarded.

[The prepared statement of Dr. Loden follows:]

STATEMENT
SUBMITTED TO THE
UNITED STATES SENATE COMMITTEE ON
ENERGY AND NATURAL RESOURCES
AUGUST 31, 1989
BATON ROUGE, LOUISIANA

Mr. Chairman and Members of the Committee:

My name is Michael S. Loden. I am the Director of the Jefferson Parish Environmental and Development Control Department. On behalf of Jefferson Parish President Michael J. Yenni, we wish to thank you for the opportunity to provide comments to the Committee.

The Parish of Jefferson lies along the Mississippi River immediately upstream from the City of New Orleans, extending from Lake Pontchartrain on the north to the Gulf of Mexico on the south. Our population of approximately 500,000 persons is concentrated within the northernmost 20% of the Parish, and is surrounded by levees. The remaining 80% of Jefferson Parish is more sparsely populated, and comprises a transition from swamps to fresh, intermediate, brackish, and saline marshes, to the open waters of Barataria Bay and the barrier island of Grand Isle. The economy of our Parish, like so many others in southern Louisiana, depends heavily on water-borne resources including oil and gas activity, commercial and recreational fishing, and transportation.

We have become increasingly involved in the abatement of coastal erosion and wetlands restoration. Jefferson Parish currently is participating with the State of Louisiana on a single project that will help protect a national park and a federal commercial waterway, and restore marsh to a relatively extensive area. We are also working with the State on a major wetlands education project. Other projects being developed include an erosion protection and marsh restoration exercise near the Town of Jean Lafitte, erosion protection in the Bayou Barataria segment of the Intracoastal Waterway, stabilization and restoration of the only known brown pelican nesting area in Louisiana west of the Mississippi River, and marsh development along the south shore of Lake Pontchartrain.

Money for the Parish share of these projects is from a dedicated source of revenue. The Jean Lafitte National Historical Park provides payment to Jefferson Parish in lieu of ad valorum taxes paid by property owners prior to the acquisition of property by the National Park Service. These payments are placed into a "Mitigation Fund", whose total now exceeds $250,000. This money is available for wetlands projects if the U. S. Fish and Wildlife Service designates those projects as mitigation for wetlands loss due to public projects in the more densely populated areas of the Parish.

State and Federal agencies have expended many millions of dollars in efforts to restore the integrity of Grand Isle, a barrier island within Jefferson Parish at the southern end of Barataria Bay. These efforts are most welcome, not only to protect the residents of Grand Isle, but also to maintain the island's effectiveness as a barrier to additional saltwater intrusion into the Barataria Estuary.

It is our opinion that a less expensive, more effective method of barrier island protection should be examined. We feel that the source of sand comprising the barrier islands in our area was sediment transported by the Mississippi River. Since the completion of the Southwest Pass of the Mississippi River in the 1950's, this sediment has been channeled off the continental shelf and into the depths of the Gulf of Mexico. Long-time residents of Grand Isle relate that while beach erosion due to storms is not new, the natural replenishment of beaches has not occurred since the completion of Southwest Pass.

We feel that the federal government should consider installing major sediment diversions or distributaries along the lower reach of the Mississippi River on the continental shelf. These would create mixing zones of fresh and saltwater nearer to shore, thereby reducing rapid salinity fluctuations; provide a source of sediments for the natural replenishment of barrier islands; and create highly productive new marshes for seafood harvesting. Because the diversion of sediments off the continental shelf to maintain open channels directly benefits commercial shipping at the expense of wetlands, we feel that the costs of evaluation and possible development and management of sediment diversions could be shared by the commercial shipping industry. We believe that Mississippi River sediments are a natural resource that should be managed rather than discarded.

The CHAIRMAN. Thank you very much for an excellent statement Dr. Loden. The Plaquemines Parish Government, Luke Petrovich, President, has submitted us an excellent statement which will be put in the record at this point.

[The prepared statement of Mr. Petrovich follows:]

Plaquemines Parish Government

P.O. BOX 61
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504-392-6690 • 504-682-0081 • 504-564-2761

Parish President
LUKE A. PETROVICH

COUNCIL MEMBERS
ALBERT J. BESHEL, DISTRICT 1
BENNY ROUSSELLE, DISTRICT 2
JERRY HODNETT, DISTRICT 3
MIKE MUDGE, DISTRICT 4
SULLIVAN J. VULLO, DISTRICT 5
MORRIS TREADWAY, DISTRICT 6
GARY RAGAS, DISTRICT 7
BRYAN DICKINSON, DISTRICT 8
ERNEST JOHNSON, DISTRICT 9
MERL D. ANSARDI, SECRETARY

August 30, 1989

Honorable J. Bennett Johnston
U. S. Senate
Chairman, U. S. Senate Committee
on Energy and Natural Resources
136 Hart Senate Office Building
Washington, D. C. 20510

Dear Senator Johnston:

One quarter of the nation's wetland loss is occurring in Plaquemines Parish.

Most of this is caused by saltwater intrusion resulting from man made projects which directly benefit the entire nation.

These projects include hundreds of interstate pipelines crossing Plaquemines Parish extending from offshore federal oil leases all the way to New England and the mid-west. They also include the deepening of the Mississippi River, by the U. S. Corps of Engineers to maintain a 45' channel through Plaquemines Parish, enhancing commerce up and down the Mississippi River where presently over 10,000 deep draft ships annually travel. Plaquemines Parish also services the federal offshore oil and gas industry, annually netting the federal government billions of dollars.

Plaquemines Parish's contributions to the nation in these areas have had a detrimental effect to the Parish's wetlands.

We are asking the Federal Government to become partners with us and the State of Louisiana in helping us to implement Coastal Restoration Projects.

Realizing the stakes involved to the people of Plaquemines Parish, the people themselves have responded to this threatened loss, which effects their home and economic well-being by taking an unprecedented step -- they voted $12.5 million revenue bonds to help fund initial coastal restoration projects. Plaquemines Parish knows the erosion problem and has a concept which is economically feasible to save the Parish from further wetland loss.

Our attention now must turn to you and Congress to implement the partnership arrangement for Coastal Restoration projects in Plaquemines Parish which have been engineered and are ready for construction.

We ask the federal government to immediately take action in this area where a national committment has already been made by Congress and the President.

Your continued efforts to support us are welcome.

We hope the attached materials will further illuminate your committee members and staff to the scope of the problem and the potential for restoration in what is perhaps the single most important national battleground for our coastal wetlands.

Sincerely,

PLAQUEMINES PARISH GOVERNMENT

Luke A. Petrovich
Parish President

LAP/lwc

Attachments

08-04089

PLAQUEMINES PARISH
COASTAL CONSERVATION & RESTORATION PROJECT
ENGINEERING REPORT

PREPARED FOR
HONORABLE LUKE A PETROVICH
PRESIDENT
PLAQUEMINES PARISH

BY
JACK HOGER
BROWN & ROOT, U.S.A.
BELLE CHASSE, LOUISIANA
JULY, 1989

Plaquemines Parish is pleased to have the opportunity to submit our recommendations and comments concerning wetland preservation in Louisiana

Plaquemines Parish has taken an initiative to control coastal erosion with two proposed freshwater diversion projects at West Pointe a la Hache and at LaReussite (Naomi). We are prepared to fund these projects totally with $12.5 million in Parish bonds. However, state and/or federal participation is welcomed and solicited, as any additional funding would permit project expansion for increased benefits. At present, these projects have been conceptually designed and permit applications are filed with the Department of Natural Resources (DNR) and the Corps of Engineers, and their approval is imminent.

The coastal erosion problems that exist in Plaquemines Parish were principally caused by two fundamental actions, the purpose of which were to serve the overall interest of the State and the rest of the nation:

a. The channelization of the Mississippi River which prevented the natural diversion of fresh water, silt and sediment from the river into the wetlands.

b. The dozens of interstate pipelines coming from the outer continental shelf waters extending into the mid-west and other points are laid in pipeline canals which impact the coastal areas of Plaquemines Parish. These pipelines serve the interest of the nation as a whole.

These national interests should be compelled to contribute to the restoration of Plaquemines Parish's coastal areas.

We are aware of our coastal erosion problems and have committed the $12.5 million previously outlined to solve the problem. We have a viable concept which includes not only freshwater diversion from the Mississippi River but also nourishing and rebuilding the coastline from Sandy Point to Grand Isle in Jefferson Parish to control intrusion of saltwater along the shoreline. These are the key points to our coastal erosion control plan, and we are prepared to embark on actual construction of these projects.

Plaquemines Parish recommends the following proposals that could be implemented immediately:

a. Modification of Canals and Spoil Banks

Canals and spoil banks that are detrimental to proper circulation of water, sediment and nutrients could be identified and then modified to prevent further erosion. Canals that are no longer in use could be blocked and altered to create a potential environment for marsh growth. Fencing could be used in shallow water areas and along the banks of existing canals to encourage the accumulation of sediment and stop further erosion respectively.

b. Nourishment by Dredge Material

Instead of disposing of dredge material into deeper waters of the Gulf of Mexico, we propose that this material be used to rebuild both marsh and our deteriorating barrier islands. Methods such as high pressure jet sprays allow for this material to be strategically placed in thin layers without harming the existing wetlands. This proposal to use dredge material is a viable solution, but because of the cost, state and federal participation is needed.

c. Permitting Procedures

The means of obtaining the construction permits for coastal and wetland protection projects needs to be re-evaluated. It would seem reasonable that permit acquisition could be expedited as the projects are driven by environmental rather than industrial considerations. Otherwise, degradation of the wetlands will continue during the permitting period resulting in an iterative and more costly engineering effort to evaluate the changes.

d. Management

Local political solvency must be preserved. Management should include cooperative agreements between local government and the State and Federal Governments. Continual management must be in the hands of local government as far as land use and zoning are concerned.

Plaquemines Parish took an initiative in this area by hiring a Project Management Consultant and organizing a coastal restoration and management meeting at the office of Brown & Root in Belle Chasse to discuss solutions to this immense problem. This meeting was attended by technical consultant, local political representatives and state and federal agencies involved in the restoration of the wetlands. We encourage this dialogue to continue so that we will be better able to achieve our goal.

Projects that are currently being proposed, designed or that are in operation to help save coastal wetlands are listed below:

a. Bayou Lamoque. Consists of two large freshwater diversions that divert Mississippi River Water into Breton Sound. These diversions are presently in operation and are controlled by the State Department of Wildlife and Fisheries.

b. White's Ditch. Freshwater diversion structures consisting of siphons that divert 200 cubic feet per second of Mississippi River water into Breton Sound. This diversion is now in operation and is controlled and funded by Plaquemines Parish Government. With extra funding, this diversion could be enlarged for increased benefits.

c. Bohemia Spillway. Structure consisting of 4-60" diameter conduits that were built in 1969 to provide for a flood relief measure to New Orleans during high river states. The structure was rarely used since its construction and is now out of service. The State of Louisiana and Plaquemines Parish expressed an interest in using this structure to divert Mississippi River water into Breton Sound. The structure needs repair, but initial investigation shows that cost would be minimum to put it back in operation.

d. LaBranche and West Pointe a la Hache Freshwater Diversions. Structures that have been conceptually designed by Prescott Follett & Associates which will be funded 100% by Plaquemines Parish Government. Final design of the projects is about to begin, and schedules show that construction could be completed by the Fall of 1990. Each structure consists of 8-72" diameter siphons that will divert 1600 cubic feet per second of

Mississippi River water into existing marsh in the Barataria Basin. Recommendations are to construct additional diversions south of West Pointe a la Hache when funding is available.

e. Pass a Loutre and South Pass Freshwater Diversions. Six freshwater diversions are presently being designed by Brown & Root, USA, Inc. in the Pass a Loutre Wildlife Management area for the the purpose of marsh creation in the Mississippi Delta. The natural levee will be breached at three sites along Pass a Loutre and three sites along South Pass. This project will be funded by the Louisiana Department of Natural Resources. Construction will be completed December, 1989.

f. Caernarvon Freshwater Diversion Structure. This federal/state project is now under construction, and will divert Mississippi River water into Breton Sound at a rate of 6,600 cubic feet per second. Completion of this project is predicted for December, 1990. Plaquemines Parish thoroughly supports this project, and recommends the continuing appropriation of federal funds.

g. Barrier Islands (Shell Island). Protection of the shore and barrier islands is essential in controlling the erosion of Louisiana's coastal area. The barrier islands help reduce the wave energy and associated erosion in the marshes behind them. Since the shoreline is the first area of attack of both wave action and saltwater intrusion, preserving the islands would keep erosion in the inland marshes to a minimum. If the islands are allowed to erode away, erosion will accelerate in the inland marshes. The Parish of Plaquemines in its concept to solve coastal erosion from the area of Sandy Point to Grand Isle is prepared to implement a

program to limit saltwater intrusion by restoring our shorelines by use of dredged material and natural littoral drift along the coast. We are prepared to implement this immediately, but we require federal/state assistance with funding.

Brown & Root, USA, Inc. completed an engineering study to restore Shell Island in April, 1988. The study estimated that it would take $14 million to restore the island. At the time the study was complete, only $7 million was appropriated by the State of Louisiana for construction, and a decision was made not to implement the design. If funding was made available, restoring of Shell Island and other barrier islands can become a reality.

h. Empire Jetties. Realizing the importance of the barrier islands, we recommend the removal of the Empire Waterway jetties. These jetties have interrupted the normal littoral drift (i.e., sediment budget) in the Sandy Point area and will continue to be a major contributor to future island degradation. The removal or partial dismantling of the jetties need to be considered in any engineering solution. Data supporting implementation of an engineering evaluation include the observed depth of the Empire Waterway in the project vicinity of (-)20 to (-)25 feet and the fact that no maintenance dredging has been necessary in the area since 1962. As the design depth of the Empire Waterway was (-)9 feet, the most reasonable explanation for the deepening of the channel is an increase in tidal current (i.e., water velocity). This would explain the observed scour in the area and indicates that tidal currents may now be adequate to maintain the channel open without the jetties. Rip-rap from the dismantled jetties

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could be used to structurally enhance the barrier islands and/or as a revetment or slope protection to stabilize the banks of portions of the Empire Waterway which are rapidly eroding in the site area.

As an alternative to removing the jetties, a sand by-pass system could be utilized. Using this design concept, a dredging pipeline system could be installed under the existing waterway. Alternately, a deposition basin could be provided to catch the littorial drift, and standard dredging methods could then be employed to periodically transfer trapped material on the updrift side of the jetties to the downdrift side.

In conclusion, Plaquemines Parish recognizes the importance of our Coastal Marshes to Louisiana's future, and we are actively working on solutions. We stress that time is of the essence, and decisions will have to be made soon to stop this catastrophic loss. Plaquemines Parish is committed to implementing solutions. We seek support in two principal areas: additional funding and expedited permit processing.

COASTAL POLICY PROPOSALS
AND
PLAQUEMINES PARISH

PREPARED FOR

HONORABLE LUKE PETROVICH

PRESIDENT

PLAQUEMINES PARISH

BY

LORI CAMERON

ADAMS AND REESE

BATON ROUGE, LOUISIANA

JULY, 1989

One quarter of the nation's wetland loss is occurring in Plaquemines Parish. The Parish has reacted by taking an unprecedented step -- funding major coastal restoration projects. This month, the State of Louisiana passed legislation creating a Wetlands Conservation and Restoration Authority and a constitutionally-dedicated fund to implement a Wetland Conservation and Restoration Plan.

Now, the focus on coastal policy has shifted to Congress where legislative proposals are rapidly solidifying. The major policy distinction is between "no net loss of wetlands" proposals, which are national in scope, and "no net loss due to development" proposals, which are tailored specifically to Louisiana.

Plaquemines Parish's interest and investment in coastal conservation and restoration has earned it a voice in federal coastal policy discussions. The opportunity exists to assure, first and foremost, that coastal restoration efforts are undertaken; that identified Parish projects are supported; that local government's concerns are addressed in the formulation of plans and regulations; and that economic development is controlled, but not prohibited, in the Parish.

INTRODUCTION

The purpose of this paper is to review a number of the pending coastal policy proposals and to provide Plaquemines Parish officials with a basis for testimony in various forums. It presents a brief history of Louisiana coastal activities, with background information which may prove useful in the explanation of coastal wetland disappearance and consideration of possible alternatives. It discusses state and local activities as well as federal proposals. It concludes with recommendations for Plaquemines Parish.

COASTAL CONCERNS

Coastal issues are as much a part of life in south Louisiana as are homes, roads, schools and jobs. The location of 40 percent of the nation's wetlands, and 80 percent of its wetland loss, concern about the coast is an inescapable part of life.

Water shapes the wetlands and south Louisiana. Water builds. Water destroys. Consequently, flood control has been synonymous with development since European settlement of the area now known as Louisiana. When Bienville founded New Orleans in 1717, work began immediately on a protective levee. Levee construction along the Mississippi River continued through the nineteenth century.

It was the disastrous flood of 1927 which caused tremendous economic devastation and killed more than two hundred people, that led to the federal government's current flood control effort; the Mississippi River and Tributaries project, which is administered and implemented by the U. S. Army Corp of Engineers (COE). Since 1928, almost six billion dollars has been invested by the federal government in COE work to protect the lower Mississippi River region.

Flood control has had two basic impacts on coastal Louisiana. First, it assured the integration of man into the coastal ecosystem. More than two million people live within the parishes which comprise the state's coastal zone. Second, it may be the single most significant factor in wetland loss. Fresh water and sediments, which would otherwise nourish the wetlands, are lost as a result of flood control efforts, over the Outer Continental Shelf (OCS), to the 1,000 foot plus depths of the Gulf of Mexico.

Man's activities in coastal regions -- canals, roads, homes, and businesses-- have further stressed the ecology, shifting the balance toward erosion. Natural forces -- subsidence and sea level rise -- have brought more sea water into coastal areas, killing marshes and destroying wetlands.

Policy meant to save wetlands, which does not provide for human activities, addresses only a selective part of the coastal ecology. Man is as much a part of the ecology as other organisms that live in the region. From the perspective of people who are owners of the wetlands and coastal residents, the end result of either coastal erosion or prohibitions against activities in the wetlands is the same: the loss of property, livelihoods and homes.

STATE AND LOCAL INITIATIVES

Coastal restoration was first addressed by the state in 1981. State Senator Samuel B. Nunez, Jr. led the Senate and House Natural Resources Committees to develop a coastal restoration plan entitled, "Report on Special Projects for Coastal Louisiana". The report identified sixteen projects across coastal Louisiana. The Legislature created the Coastal Environmental Protection Trust Fund, dedicating monies to prevent and control coastal erosion and subsidence.

Although the Legislature provided a list of projects and the funds with which to pursue them, coastal restoration efforts were stymied administratively by red tape and jurisdictional squabbles. What amounted to a death blow for on-going coastal restoration came in 1988, when all statutorily dedicated funds were seized to help defray the state's general fund deficit. At the time, the Coastal Environmental Protection Trust Fund consisted of over thirty-six million dollars.

Nunez came back in 1989 with a new approach, creating a Wetlands Conservation and Restoration Authority in Act 6 of the Second Extraordinary Session of 1989. The work of the Authority will be funded in part by a constitutionally dedicated fund, as provided for in SB 25 of the Second Extraordinary Session of 1989, by Senator Ben Bagert. The constitutional fund provision goes to the voters for approval on an October 7, 1989 state-wide ballot. If adopted, the Wetlands Conservation and Restoration Fund will receive state mineral revenues up to a limit of forty million dollars.

The Wetlands Conservation and Restoration Authority (the Authority) is, in fact, one person, an executive assistant, appointed by the Governor and charged with developing a state coastal vegetated wetlands conservation and restoration plan (the Plan) for Louisiana. The executive assistant is the designated coastal policy spokesperson for the state, the single voice with which Louisiana will speak on coastal matters.

Although the Act creates an eight member task force, mainly members of the Governor's cabinet, it is silent on the task force's duties or authorities. The Act states only that the Task Force will be chaired by the executive assistant, who will develop procedures for its operations. Act 6 also creates the Office of Coastal Restoration and Management within Louisiana's Department of Natural Resources (DNR), comprised of a Coastal Management Division to conduct permitting and a Coastal Restoration Division to implement the Plan.

Undoubtedly, the Plan will include aspects of the Governor's Coastal Restoration Policy Committee report, prepared in the summer of 1988 under the direction of Manny Fernandez of the Governor's Office. This report was careful to point out that "the causes and extent of deterioration and continued human presence preclude the complete restoration of the entire historic vegetated wetland resource base of Louisiana. Even fully reversing the current rate of marsh loss is highly unlikely." What the report did recommend was the restoration or creation of vegetated wetlands on a localized basis where new sources of water and sediment are available, and intensive marsh management where fresh water and sediment was not available.

The report recognized nine hydrologic basins within the state. Three of those nine basins converge in Plaquemines Parish. They are the Breton Sound Basin to the east, the Mississippi River Delta, and the Barataria Bay Basin to the west. In addition to coastal recommendations, it identified projects for coastal protection and restoration in each basin. Sixteen of the forty-two recommendations were located in one of Plaquemines Parish's three basins.

The emphasis on Plaquemines Parish is justified in that one-third of Louisiana's wetland loss occurs in the Parish. Given that 80 percent of the nation's wetland loss is in Louisiana, fully one in four coastal acres lost in the U. S. are in Plaquemines Parish.

A small parish, Plaquemines has taken an unprecedented step and issued revenue bonds to fund local coastal restoration projects. When construction concludes next year, the Parish will have spent roughly the same amount that the state has -- about ten million dollars -- on project construction.

The two underway projects incorporate one of the most promising methods of wetland restoration, controlled fresh water diversion. By diverting fresh water from the Mississippi River, the Parish hopes to restore the saline/fresh water balance, thereby promoting marsh development. The Parish has been unable to pursue a number of additional projects which, with engineeering work complete, lack only funding. Other methods of coastal restoration under consideration by the Parish include barrier island management and utilization of dredged material.

Although on a different scale, these are the same methods being evaluated by some large landowners in the wetlands. It is estimated that 80 percent of Louisiana's wetlands are privately owned. Given the substantial investment of the state, Plaquemines Parish, and private interests throughout south Louisiana, federal coastal proposals are being closely scrutinized.

LOUISIANA-SPECIFIC FEDERAL INITIATIVES

Chief among federal coastal efforts is Senator John Breaux' S 630 "Louisiana Coastal Wetlands Conservation and Restoration Act", which is co-sponsored by Senator J. Bennett Johnston and Senator George Mitchell. Drawing on the work of the Governor's Task Force and others, Breaux' bill goes to the heart of 80 percent of the nation's wetland loss -- protecting and restoring coastal Louisiana.

The goal of Breaux' bill is "no net loss of wetlands as a result of development". Its purpose is to address rapid loss of coastal wetlands within Louisiana and to authorize the state to develop and implement a program that achieves a goal of no net loss as a result of development.

The bill is based upon a cooperative effort among the COE, the U. S. Environmental Protection Agency (EPA), the State of Louisiana. These three entities are to agree to a process which would designate a single state agency to develop a Coastal Wetlands Conservation and Restoration Plan within three years. Over that period the state would receive $15 million from the federal government to assist in the planning process. To allay fears that current, on-going projects might be delayed by the three year planning process, the bill provides that federal officials shall continue coastal restoration and conservation projects commenced in Louisiana and that such authorized projects will not be conditioned on payment of a non-federal cost share.

According to the bill, the goal of no net loss due to development shall be achieved "in a manner that recognizes the multiple uses of the wetlands and balances within the limits of the goal the economic needs of the state with regard to wetland development, conservation and restoration." Key elements of the plan would include identification of the area of coastal wetlands in the state, designation of a single state agency for implementing and enforcing the plan, permitting to assure no net loss of wetlands due to development, a wetlands accounting system, a prioritized schedule for restoration, and public education.

Under S 630's approved plan, the state would assume permitting now done by the COE in conjunction with EPA, under the Section 404 program of the Federal Water Pollution Control Act (FWCPA). The permitting system would also assure compliance with inspection, monitoring, and entry requirements of the FWPCA and the U. S. Fish and Wildlife Service's (FWS) consultation requirements under the Endangered Species Act.

Once the plan is completed by the state, it would require approval by the COE and EPA. Thereafter, the state would receive five percent of all bonuses, rents, and royalties from federal OCS leasing operations to implement the Plan. Breaux points out that the five percent amounted to about one hundred forty-five million dollars last year. Projects would require ten percent state funding, but that amount could be in the form of in-kind contributions.

From a coastal policy standpoint, the bill proposes a landmark change with regard to the COE. It would expand the COE mission statement to include "protection, restoration and creation of vegetated wetlands, ...such projects to be given equal priority with projects relating to navigation and flood control". This will allow the COE, which has been so successful at flood control, to focus on coastal protection and restoration as well.

U. S. Representative Billy Tauzin, whose congressional district encompasses much of Louisiana's coastal area, has also proposed legislation addressing coastal restoration. To illustrate how quickly federal coastal proposals are evolving, Tauzin is currently drafting a second coastal restoration bill. Tauzin's first bill, HR 824, was filed February 2, 1989 and is entitled the "Coastal Wetlands Recovery Act". It is the same bill filed during the previous session of Congress.

Under the terms of HR 824, the Secretary of the Army would identify threatened coastal wetlands and within six months designate the ten most threatened wetlands in the nation. Within two years the Secretary would prepare an action plan for those ten most threatened wetlands and within five years a plan for each threatened coastal wetland.

These plans would be developed in conjunction with the coastal state's lead agency and would incorporate the state's recommendations unless considered not technically feasible. The plans would be required to be consistent with federal law and with the federal Coastal Zone Management Act. At least twenty-five percent of the cost of implementation of the plan would have to be non-federal although the non-federal share could be in-kind contributions.

Tauzin's HR 824 would authorize federal appropriations not to exceed thirty million dollars per year for any single coastal wetland program. Importantly, twenty million dollars per year would be available immediately for demonstration projects.

Tauzin hopes to file a second coastal restoration bill shortly. It will address problems he fears the state might have under the terms of the Breaux bill. Tauzin is particularly concerned about the state's assumption of the Section 404 permitting program. He feels that program, in its current form, regulates the deposition of dredge material on the basis of national standards, which do not work to Louisiana's best advantage, especially when dredge material might be used to restore the state's coastal areas. Tauzin worries that the state might be stuck enforcing rules that work to its detriment.

Additionally, Tauzin would like to give the state authority to expedite approval of "favored" projects which would protect coastal wetlands. Finally, Tauzin is considering a wetland mitigation banking system which would allow development in certain wetland zones in exchange for mitigation credits in other zones.

GENERAL FEDERAL PROPOSALS

In addition to Louisiana-specific proposals, there are numerous general federal wetland proposals. Most are based on what might loosely be called the "EPA-Bush Administration initiative." President Bush has repeatedly called for a strong federal commitment to wetland conservation and restoration and no net loss of wetlands.

On November 15, 1988, the National Wetland Policy Forum, a group sponsored at EPA's request by the Conservation Foundation, culminated two years of work with the release of a final report. The project had been chaired by Conservation Foundation Chairman William Reilly, who was shortly thereafter tapped by President Bush to be Administrator at EPA. In January of 1989, the EPA announced a new Wetland Action Plan, incorporating more than one hundred specific recommendations from the Forum report.

The Wetland Action Plan seeks to increase protection of wetlands and streamline permitting activities in wetlands nationally. EPA has adopted the goals of the Forum report: a) to achieve no overall new loss of the nation's remaining wetland base, as defined by acreage and function; and b) to restore and create wetlands, where feasible, to increase the quality and quantity of the nation's wetland resource base.

The general recommendations of the Forum report were: a) the development and use by all regulatory agencies of a standard definition of wetlands; and b) the transfer of primary responsibility for Section 404 permitting from the federal government to states with EPA-approved wetland conservation plans. Rather than propose an omnibus piece of legislation, the Forum report proposes separate pieces of federal legislation on fees, conservation programs, and other matters as well as administrative revisions to Executive Order 11990.

EPA has established seven objectives to implement its goal:

A. A wetlands planning initiative;
B. Mechanisms to increase state/local role in wetlands protection;
C. Section 404 regulatory fixes (dealing with enforcement guidelines and jurisdiction/delineation);
D. A mitigation policy;
E. Public information and education;
F. A cumulative wetland loss and degradation impact assessment study; and
G. Wetland restoration.

One of the Section 404 proposals, calling for a uniform definition of wetlands was quickly implemented. In January, 1989 the EPA, COE, FWS and Department of Agriculture's Soil Conservation Service agreed to adopt a single technical manual for use in identifying wetlands. The Joint Federal Manual for Identifying and Delineating Wetlands became effective on March 20, 1989.

The EPA Wetland Action Plan is not limited to coastal wetlands. For instance, the document contains regional highlights dealing with inland wetland loss in the central migratory bird flyway in Kansas, and the prairie pothole region of the northcentral U.S. However, a Coastal Louisiana Initiative, which targets the region for restoration as well as protection, is also part of the EPA Plan. EPA is using three alternatives to achieve wetland goals in Louisiana -- planning, regulation, and research and development.

Region VI of EPA is working with the state and the COE on a number of major planning efforts including 1) a Louisiana comprehensive coastal wetlands plan, 2) Louisiana marsh management strategies, 3) marsh management programmatic environmental impact statements; 4) a land loss and marsh creation study; 5) a shore and barrier island initiative, and 6) environmental impact statements for COE dredge disposal sites.

On the regulatory side in Louisiana, EPA intends to review about one thousand individual Section 404 permits and increase enforcement efforts. Table 1 lists the ten on-going EPA research and development projects relating to coastal Louisiana.

TABLE I

EPA REGION VI
ONGOING LOUISIANA
COASTAL RESEARCH AND DEVELOPMENT
PROJECTS

1. Cumulative impact assessment of losses in the Pearl River Basin
2. Advance identification of priority wetlands near Slidell, Louisiana
3. Designation of Barataria Bay Basin into the National Estuary Program
4. Atchafalaya Basin Delta Creation Studies
5. Louisiana coastal area - Mississippi River Delta Study
6. Interpreting and digitizing aerial photos of coastal Louisiana
7. Mapping field monitoring impact assessment of marsh management areas
8. Oil and gas operations impacts handbook for wetland managers
9. Golden Meadow Plant Materials Laboratory erosion control
10. Gulf of Mexico Program

Source: Office of Water, Office of Wetland Protection. U. S. Environmental Protection Agency. Wetlands Action Plan. Washington, DC, January, 1989; p. 6.

CONCLUSION

Perhaps no other entity has the interest, or as much at stake, in coastal restoration as does Plaquemines Parish -- site of one-quarter of all the wetland loss in the United States.

The passage of Act 6 of the Second Extraordinary Session of the Louisiana Legislature, creating the Wetland Conservation and Restoration Authority shifted the focus on coastal policy making to the federal level and Congress. There are two principal policy directions, each concerned with no net loss of wetlands. The "EPA - Bush Administration" approach, based on the National Wetlands Policy Forum report, is no net loss of wetlands by function or acreage.

The second policy approach is specific to wetland loss in Louisiana (site of 80 percent of the nation's wetland loss). Its proponents call for "no net loss as a result of development". The distinction between the two policies is absolutely critical to Louisiana.

If development is prohibited in areas where overall wetland loss is occurring, economic activity will grind to a halt in south Louisiana. If, however, wetland loss is considered on a project-by-project basis, losses may be mitigated as required by the permitting process, and economic activity may continue.

The Governor's Coastal Restoration Policy Committee Report made an important point in this regard; "Solutions must deal with the dynamic nature of Louisiana's coast and the complex interactions between natural processes and human activities, and must consider flood control, navigation, and other water-dependent aspects of coastal resource use." The two parish-funded freshwater diversion projects are part of such a solution, as are other projects the parish has ready for construction.

Plaquemines Parish's interest and investment in coastal conservation and restoration has earned it a voice in federal coastal policy discussions. The opportunity exists to assure, first and foremost, that coastal restoration efforts are undertaken; that identified Parish projects are supported; that local government's concerns are addressed in the formulation of plans and regulations; and that development is controlled, but not prohibited, in the Parish.

The CHAIRMAN. Now before we start talking about the specific things that may be done, let me see if we have an agreement on one thing from our witnesses, or whether we don't. We're talking about 40 square miles a year being lost. By the way, where did that figure come from, do you know Colonel Gorski?

Colonel GORSKI. Mr. Chairman, there has been a number of different studies over the years. I think Dr. Templet could probably tell you some of them. There is a study ongoing now at our Waterways Experiment Station in Vicksburg. Based on data up through 1983, it is going to suggest that the figure is now closer to 35 square miles per year and that the rate of loss is decreasing, but that study is not yet finalized. It's just preliminary data. The results are promising.

The CHAIRMAN. Let us hope so. Now each of you has talked about various things that can be done. All have involved, at least in part, the building of structures, diverting of water, to some extent the mimicking of the Mississippi River, not all together, but to some extent. Now if we preserved all that we could preserve, are we talking about an expensive process here? Colonel Gorski?

Colonel GORSKI. Sir, without question, it is an expensive process. A major diversion of the Mississippi River under any circumstances would be an expensive process. The amount of——

The CHAIRMAN. What order of magnitude are we talking about?

Colonel GORSKI. Sir, I think that you could put any number you want to against it. It would depend on how much you could spend.

The CHAIRMAN. Well, I mean are we talking about hundreds of thousands, tens of billions, just give me a general idea. The reason I ask is my legislation contemplates $80 million to $10^ million a year. Is that the kind of problem we are talking about?

Colonel GORSKI. Mr. Chairman, part of the answer to your question is what do you want to achieve? If the aim is simply to maintain existing shoreline where it is today and to preserve existing vegetated wetlands and to restore as much of the wetlands that have been lost within the shoreline, then I think you would be talking in the hundreds of millions of dollars over an extended period of time.

The CHAIRMAN. That would be possible to do given that kind of resource? That kind of financial resource?

Colonel GORSKI. I think you could make a great contribution to it. Yes, sir.

The CHAIRMAN. Dr. Templet, what kind of money are we talking about?

Dr. TEMPLET. I think the figure you brought out is fairly close. The $100 million per year. My calculations show that we need about 20 diversions of the size of Caernarvon. That's probably half a billion dollars spread over 20 years I would suspect. But there are some economies of scale. Instead of building a lot of caernarvons, we build some bigger ones.

Mr. CHAIRMAN. About 20 diversions you say?

Dr. TEMPLET. That's my estimate, yes. Instead of using control diversions, there are places where I think we could just put sills in the Mississippi River levee south of all development. When the spring flood reaches a certain high, it begins to spill over.

Mr. CHAIRMAN. We will get into that, but the amount of money we are talking about, you do agree, is in the half billion dollar category?

Dr. TEMPLET. For the diversions, that would be my guess, and the hundred million dollars a year will help you begin that.

Mr. CHAIRMAN. Dr. Loden do you have a view on that?

Dr. LODEN. With regard to preserving what we now have, we have looked all over Jefferson at various problems. Some of them there's no way we could save it. We have to, in some cases, cut it loose in order to concentrate our efforts in areas where we're more likely to have success. I think that the whole coastline needs to be looked at with that respect. We can't preserve everything.

The CHAIRMAN. Do you have a view on the amount of money?

Dr. LODEN. On the money, you're way beyond my capacities for——

The CHAIRMAN. We will get back to the question of what to do. Ms. Van Sickle you have talked about a whole series of things from planning of salt resistant grasses to a lot of other things. Does your solution involve structures which are expensive, and if so, what kind of dollars are we talking about?

Ms. VAN SICKLE. Yes, from small structures that may cost $10,000 like a weir, to a large freshwater diversion. The Caernarvon structure, for example, is $25 million, $30 million? So we've already picked out seven locations just amongst the secretaries of the different departments involved for major diversions. Seven times 25 that gives you the ballpark range of how many millions of dollars we could spend.

The CHAIRMAN. Well actually, the Bonnet Carre, as I understand it, is a $69 million project. The Mississippi River, Mississippi delta region on salinity control, that is the four structures, Bohemia, Caernarvon, Davis Pond and Home Place, are a total of $77 million. Am I correct on that?

Colonel GORSKI. Senator, I would say one thing: We are only constructing or planning on three diversions projects: Bonnet Carre, Caernarvon, and Davis Pond. The other structures, although they were authorized and have been mentioned before, are not now in the planning stages.

The CHAIRMAN. Right. I have a document here put out I think by the Corps of Engineers which puts a cost amount on the four structures which are planned and the figure we have is $77.2 million. I understand that is not now in the funded planning stage, but it is a figure used by the Corps of Engineers for cost. What I am trying to get at is what it costs to do what we want to do if we do it. If we have the resources. In other words, the point is Ms. Van Sickle, that in your view, in addition to some simple, reasonably cost things, we are talking about big bucks.

Ms. VAN SICKLE. The major big bucks would be for sediment reduction related to the Mississippi River and the problem that we've created by channeling the river and the levee. This is all a problem.

Mr. CHAIRMAN. There are seven projects which have been now identified. I think the State has identified the seven (20 you would like to do, but seven have been identified). Colonel Gorski, is there sort of a meeting of the minds that seven would be good if you

could do them, if they were authorized, if they were funded? Do you know what seven they are talking about?

Colonel GORSKI. Yes, sir, I know which seven they are talking about, but I don't know if a meeting of the minds is an accurate way to describe it. The various diversions have been looked at by a number of different agencies and groups. One of the purposes of the Louisiana Comprehensive Coastal Wetlands Study would be to take a further look at all of the proposals submitted to the Governor last August and to try to assess the cumulative impacts of those structures and to assess the cost of those structures and the effectiveness of them. I would also mention that as we begin to divert major portions of the Mississippi River there is going to be a synergistic effect on the navigation system in the river. And while all of the efforts to preserve and restore wetlands are certainly laudatory, one of the longtime missions of the Corps of Engineers has been to maintain navigation in the Mississippi. The impact of diverting more water and diverting more sediment in the river will have some kind of synergistic affect on navigation which we have not yet begun to calculate.

Mr. CHAIRMAN. All of the witnesses have talked about diversion of Mississippi River waters. Dr. Templet talks about rerouting navigation traffic out of the lower Mississippi River, above Head of Passes and promoting the delta building in the lower Barataria. I think Dr. Loden has talked about essentially the same thing and Ms. Van Sickle, you have talked about delta building as well.

Now Colonel, as I understand it, all agree that the levee and the Mississippi River, that the focusing of the flow through southwest pass has had a deleterious effect on delta building on our marshlands. As I understand it, there is something that can be done about this, and that is to build a navigation canal, diverting traffic out of the Mississippi River below New Orleans. We are not talking about the Gulf Intercostal Waterway which is too small, but to build a brand new one. Is that correct?

Colonel GORSKI. Yes, sir.

The CHAIRMAN. Would you describe what that would be?

Colonel GORSKI. We were finishing the final stages of a study which is looking specifically at creating a navigation channel below New Orleans. The results of that study is essentially that it is not economically justifiable. In other words, the benefits of doing that economically do not outweigh the costs. The order of magnitude for something like that, depending on how the structure would be designed, probably a series of structures, would be anywhere from one to four billion dollars. This is on the presumption that you want to maintain deep water navigation to New Orleans and to Baton Rouge.

The CHAIRMAN. I think that is a safe presumption. [Laughter.]

Now is there no other way to reroute this traffic as we have discussed here, other than building that $1 billion to $4 billion structure?

Colonel GORSKI. None that we have been able to determine so far.

The CHAIRMAN. You say this would not pass a benefits-cost ratio. What kind of value do you assign to wetland preservation and en-

hancement in that study that said it does not pass benefit-cost ratio? Do you recall?

Colonel GORSKI. I do not have the exact numbers. I would be happy to provide that for the record.

[The information follows:]

We have just completed a reconnaissance report dealing with just that question. We have found that major diversions of Mississippi River flow and sediment are engineeringly feasible; however, the impacts of the large volumes of freshwater on the estuaries where such flows could be diverted make such diversion economically and socially undesirable.

The primary constraint to the diversion of Mississippi River flow and sediment for building land is the deep-draft navigation channel in the river and its Southwest Pass. Most of the river flows are needed to help hydraulically maintain the navigation channels. Major reductions in flows would significantly increase maintenance dredging and its cost. Two conceptual plans were considered for increasing the land-building capacity of the Mississippi River; (1) diverting flow and sediment from the river while maintaining deep-draft navigation in the present river channel, and (2) relocating the deep-draft navigation access channel between the river and the gulf, freeing the lower river for sediment diversion. The former was selected for further analysis as it had the highest potential for implementation.

A plan using navigation locks to separate the major river flow and the shipping traffic would cost approximately $1.5 billion. The most cost effective plan would accomplish the diversion by constructing an uncontrolled diversion of the main river flows to Breton Sound. Features of that plan include (1) a pilot channel between the Mississippi River and relatively deep water in Breton Sound, (2) extension of the intakes for the municipal waterworks at Bootheville, Louisiana, on the west side of the Mississippi River upstream of the diversion channel to mitigate increased saltwater intrusion, and (3) extensions of the jetty along the west side of the Mississippi River-Gulf Outlet to prevent excessive sedimentation in the navigation channel. The diversion of flow and sediment from the river at Bohemia, Louisiana, would result in a significant increase in maintenance dredging in the Mississippi River.

Such diversions would result in the creation of an estimated 89,300 acres of land over the 50-year project life, most of which would be wetlands. The large volume of freshwater required to divert the sediment to build land would result in the conversion of thousands of acres of brackish and saline marsh in Breton Sound to fresh and intermediate marsh. This freshening would have a drastic impact on the estuarine-dependent marine fisheries of the Breton Sound Basin. The losses to these marine fisheries would greatly exceed the value of the commercial fish and wildlife and recreation that would accrue to the wetlands created.

The estimated first cost of the plan for diverting flow and sediment at Bhoemia without locks is $102,000,000 and average annual operation and maintenance cost is $15,600,000, which includes $11,100,00 for the increased maintenance dredging in the Mississippi River downstream of the diversion channel. The average annual cost of implementing the plan is estimated at $26,700,000 and the average annual losses to commercial fisheries would average $5,200,000. Average annual benefits to commercial wildlife and recreation would average $1,500,000. The resultant benefit-cost ratio is 0.06. A benefit-cost ratio of 1.0 or greater is necessary to establish a Federal interest.

Conclusions of the study are that measures to effect major diversions of Mississippi River flow and sediment to shallow water area for the purpose of building land are not economically feasible and are therefore not in the Federal interest.

The CHAIRMAN. Dr. Templet, you talked about implementing a phased diversion of Mississippi River waters into the Atchafalaya on an estimated two percent per year until 50 percent is reached in ten years. Do you mean to change the 70/30 basis now on a basis of two percent per year?

Dr. TEMPLET. Right. In that range, one and two percent per year more water down the Atchafalaya will build a better delta in the Atchafalaya Bay. You do it in the months when there's surplus water in the River anyhow (in the Mississippi) so you won't effect navigation.

Mr. CHAIRMAN. Colonel, what would be the effect of that?

Colonel GORSKI. Sir, could you elaborate on your question?

Mr. CHAIRMAN. Yes, Dr. Templet said that we should divert Mississippi River water into the Atchafalaya increasing that proportion on the basis of two percent increase a year until you get to a 50/50 mix.

Colonel GORSKI. Mr. Chairman, we currently operate the Old River Control Structure complex to balance the flow at the latitude of Old River so that 30 percent of the combined flows of the Red and the Mississippi go down the Atchafalaya and 70 percent go down the Mississippi. We also balance the sediment load to maintain the proportions as were extant in the late 1950's when that project was designed. The reason for the project was to prevent the Atchafalaya from capturing the Mississippi. It was decided at the time the project was authorized and construction begun to maintain the existing distribution of flows. It is certainly technically feasible to increase the distribution down the Atchafalaya. It would certainly increase the delta building taking place at the mouth of the Atchafalaya. The danger is, and we have not done any studies to determine what the precise point is, but the danger is that once you build the momentum in the Atchafalaya, it would want to capture the entire flow of the Mississippi and become the new distributary of the Mississippi River.

The CHAIRMAN. You would control though the amount of flow through the Old River structure. It would seem to me that the ability of the Atchafalaya to capture is a function of the soundness and integrity of the Old River structure rather than the amount of silt which is put into and water which is put in the Atchafalaya. Is that not correct?

Colonel GORSKI. Sir, let me use this year as an example. This spring we had high flows in the Mississippi River. Significantly high flow that caused a great deal of extra effort in our Maintenance Dredging program. The amount of water and sediment we would have been able to divert this year, this spring, would certainly have been above the norm. If we would want to maintain some kind of average over the year, we would have then been faced with the situation we now have, which is below normal flows in the river. And the difficulty in predicting the Mississippi is well known. We do not know six months in advance what the River is going to do. To try to balance over the year's time is very, very difficult. If we could show that there would be no detrimental effects to the navigation system and to the other Federal projects and to state interests as well, we could certainly come up with some kind of appropriate figure that distribution could be changed to.

The CHAIRMAN. Does reducing the flow in the Mississippi River result in more siltation requirement of additional dredging or does that present a problem?

Colonel GORSKI. Yes, sir, unfortunately there is no simple answer. When the flow in the river is reduced, when the headwater flows upstream are reduced, the sediment carrying capacity of the river is also reduced. So therefore during low flow times we would have less sedimentation in the river. This week we have dredges working in the crossings below Baton Rouge because we are experiencing a great deal of sedimentation as the river slows down. We are experiencing similar phenomenon just above Head of Passes, something we were not expecting given the flow, just the low amount of water coming down the river. There is a very complex regime in the river. It's not a simple process, but generally speaking, the less amount of water coming down the river, the less sediment, too.

The CHAIRMAN. If we did anything that you think we ought to do, you believe we can stop coastal erosion if we have these hundreds of millions of dollars?

Colonel GORSKI. No, sir, I don't believe we can. The history of the Mississippi Delta, as Ms. Van Sickle has pointed out, has been one of constant delta building and delta erosion. The current Mississippi Delta is not the one that existed 500 years ago, or 2,000 years ago. It's a dynamic process which changes over time. And to think that we could fix in time the current river and the current shoreline, I think is a very optimistic, perhaps arrogant, position.

The CHAIRMAN. Colonel, Ms. Van Sickle talked about the building of our barrier islands by pumping in sand to which she described cost estimates. In your view can this be done, and are the costs estimates realistic?

Colonel GORSKI. I cannot confirm her cost estimates. I'd be happy to provide the ones that we have looked at in our barrier island study. I will tell you that we have not been able to design economically feasible projects. Again this is under the use of the regulations and policies that we follow. We've not been able to design economically feasible projects to protect the barrier islands in Louisiana.

[The information follows:]

Feasibility studies were conducted to define costs and benefits associated with restoration of barrier islands and beaches in Plaquemines and Jefferson Parishes, Louisiana. The project would encompass the arc-shaped chan of barrier islands and barrier beaches that extend from Barataria Pass generally eastward to Grand Bayou Pass. Grand Terre Island, at the west terminus of the project area, is about 40 miles south of the City of New Orleans and lies just northeast of Grand Isle, Louisiana, across Barataria Pass. The study focused on defining and assessing the possible consequences of restoration and maintenance of the approximately 16.3 miles of barrier islands and barrier beaches of the project area to recent historic conditions. Basic plan descriptions and costs are given in the following paragraphs.

Plan Descriptions

Each of the alternatives developed is a combination hurricane protection, barrier island and barrier beach erosion abatement, and marsh loss reduction plan. The hurricane protection component of the plans would provide varying degrees of protection from all storms with recurrence intervals greater than about 10 years. This protection would be realized in terms of allowing reductions in the required heights of inland ring levee hurricane protection systems that provide protection against specific design storms. The barrier island restoration, barrier beach erosion abatement, and marsh loss reduction components of the plans would, to varying degrees, retard wave induced marsh losses and retreat of the gulf shore line in the Barataria Basin.

Plan 1:

This plan consists of restoration of the barrier islands and barrier beaches between Barataria Pass at the west end of the project and Grand Bayou Pass on the east. The restoration would consist of the hydraulic placement of a sand-fill beach with 1-foot vertical to 30-foot horizontal beach face slope extending approximately 225 feet above the water line (mean tide level). The design template also includes a beach berm with a 50-foot wide crest at elevation 5.5 feet NGVD (National Geodetic Vertical Datum) and a 1-foot vertical on 20-foot horizontal back slope to tie into existing ground level. Provision for periodic nourishment of the sand beach face and sand placement at the margins of tidal inlets where erosion trends are expected to be intensive is included as a plan feature.

An additional plan feature calls for provision of a trilateral stone and shell jetty to protect historic Fort Livingston, located on the western end of Grand Terre Island, from shore line retreat and damage. The total cost of this plan (over the 50-year project) is estimated as $64.1 million, or about $3.9 million per mile.

Plan 2:

This plan includes all of the features of Plan 1. With Plan 2, a vegetated sand fill dune would be provided in addition to the sand fill beach section described above for Plan 1. The sand fill dune would have a 10-foot wide crown at an elevation of 11.5 feet NGVD. The dune back slope would be 1-foot vertical on 5-foot horizontal and tie into existing ground. Toward the Gulf, the dune would slope at 1-foot vertical on 5-foot horizontal from the dune crest to elevation 8.5 feet NGVD and would then continue at a slope of 1-foot vertical on 30 feet horizontal to form a continuous beach slope to the waterline.

The total cost of this plan (over the 50-year project) is estimated at $70.1 million, or about $4.3 million per mile.

Plan 3:

This plan includes all of the features of Plan 1. Additionally, Plan 3, calls for back filling selected abandoned oil and gas exploration canals on the bay side of the barrier islands with unclassified dredged material (not necessarily sand). The back fill would be placed to an elevation of 4.0 feet NGVD and extended into the back bay to produce total minimum island widths of about 475 feet.

The total cost of this plan (over the 50-year project) is estimated as $75.2 million, or about $4.6 million per mile.

Plan 4:

Plan 4 incorporates all of the features of Plans 1, 2, and 3, that is, beach nourishment, dune construction, and back filling of abandoned oil and gas exploration canals.

The total cost of this plan (over the 50-year project) is estimated as $82.1 million, or about $5.0 million per mile.

Plan 5:

This plan consist of back filling abandoned oil and gas exploration canals on the bay side of the barrier islands with unclassified dredged material (not necessarily sand). The back fill would be deposited to elevation 4.0 feet NGVD and extended bayward to produce minimum island widths of 875 feet. A dredged material berm with a 10-foot wide crown at elevation 5.5 feet NGVD and 1-foot vertical on 5-foot horizontal side slopes would be constructed approximately 250 feet bayward of the gulf shore line. No provisions for dune construction or beach restoration and periodic nourishment are included in this plan. Instead, approximately 900 feet of gulf shore line erosion and retreat would be allowed. Minimum barrier island widths would be maintained with periodic nourishment of the bay side of the islands with unclassified dredged material.

The total cost of this plan (over the 50-year project) is estimated as $46.0 million, or about $2.8 million per mile.

The CHAIRMAN. The pumping of sand. Is it that it does not work or it is not economically feasible?

Colonel GORSKI. It's not economic in many instances. For example, in the Grand Isle Protection Project, when we designed the repair of the Grand Isle Barrier Protection Project that we are about to begin we presumed we would be able to use a borrow area on the east end of the island. The cost of borrow from that borrow pit was going to be about $4.60 a cubic yard. The Environmental Protection Agency has asked us to move offshore for a source of material because of the use of that area by the Piping Plover and Peregrine Falcon. To go offshore to provide the same quality of material is going to cost us $7.10 a yard. And that will be not only for the construction of the project but over the long-term as well. Every three to five years we'll have to spend $2 or $3 million to renourish what gets washed away by storms.

The CHAIRMAN. What you are saying is pumping in sand does not last? You pump it in and it washes away and you have to repump it in?

Colonel GORSKI. Yes, sir.

The CHAIRMAN. Are you saying it is no solution to pump in sand?

Colonel GORSKI. It's a solution, but it's an ongoing maintenance problem. It's very similar to maintaining navigation in the river. Just because we cut a 45-foot channel two years ago doesn't mean we have it all the time. We have to continually maintain it and it's very similar in Barrier Islands. Mother Nature wants to wash those islands and move them around as has been the history of Grand Isle. It has not had a stable shoreline. And what we are trying to do is fix that shoreline and fix the shape and location of the island.

The CHAIRMAN. You and I have talked about that in the case of Grand Isle.

Colonel GORSKI. Yes, sir.

The CHAIRMAN. You have said to me privately that Grand Isle will be there from now on—as I understand it—it will just move around. It will build on one end and erode on another end and then come back, but it will be there. Do I understand you correctly on that?

Colonel GORSKI. I think in the short run, yes, sir, in the next few decades, to say that it will be there 500 years from now, I think, would be very presumptuous.

The CHAIRMAN. Will the other islands, Dernieres Isle off Terrebonne for example, will that stay or is that likely to be gone?

Colonel GORSKI. Sir, I think you can look at the geologic maps of the coastline of Louisiana and see how the delta building process has ebbed and flowed. Look at the Chandelieur Islands that were produced by deltas about 600 years ago. All that's left of that delta is the Chandelieur Islands. The trace of another delta is where Grand Isle comes from.

Under the current flows, that is the sediment flows and freshwater flows that the Mississippi is producing, if we maintain that, I would expect that Grand Isle would stay there for quite a long time. But I'm not prepared to say that it's a permanent fixture in the Gulf of Mexico.

The CHAIRMAN. Dr. Templet, do you and the Corps of Engineers generally agree on what the solutions are for Louisiana wetlands?

Dr. TEMPLET. Not normally [Laughter.]

The Colonel tends to be a little more pessimistic than I am and he's bound by a cost benefit and real world things that sometimes I don't have to be bound by. For instance, he mentioned that getting ships out of the Mississippi river above Head of Passes would cost $1 billion to $4 billion and it's not economically feasible. We are talking about saving a resource that produces a billion dollars a year. I think it's economically feasible, but I don't have to do a cost benefit.

On diverting more of the water down the Atchafalaya—the problems the Colonel described, I think, are problems that we can solve through engineering techniques. They sound fairly soluble to me. As to whether or not it's a good idea to do it because the Atchafalaya Channel might want to take the Mississippi; if you look at the project storm for which that whole system was built, we do intend to put 50 percent of the Mississippi's water down the Atchafalaya. We are heading in that direction already and to say it can't do it, I think is maybe you do foreclose some of your options if you move in that direction, but I don't see what they are. I think we can handle those kinds of problems.

The CHAIRMAN. Let me interrupt you at that point. Colonel, a 70/30 of course, is stated in the law as a percentage. Do you have the authority to study the effect of what Dr. Templet says we ought to do under the present law, or would you need a Congressional authorization for that?

Colonel GORSKI. Senator, I'd have to provide you that answer for the record. I've already asked my staff on an informal basis to give me an analysis of that and to tell what additional authority, if any, we would need to do a complete study of all of the impacts of that. It's obviously not a simple answer and so the more comprehensive the study, the less authority I have to do something like that. But a preliminary analysis we are already working on.

[The information follows:]

We have authority to study the feasibility of alternative distributions of flows between the Mississippi and Atchafalaya Rivers under the Atchafalaya Basin (Water and Land) Resources, Louisiana, study. One of the authorizing resolutions for the study specifically directed a review of the operation of the Old River System. In a report completed in January 1982, we recommended that the distribution of flows not be changed. We expect to receive completion funds for the remaining portion of the study in Fiscal Year 1990. Further studies under this authority would require additional funding.

The CHAIRMAN. If you would do that, along with not only the cost, but the benefits of it, do you agree that it would benefit delta building in the Atchafalaya Basin?

Colonel GORSKI. Yes, sir, it would certainly do that, but it would be at the expense of something else.

The CHAIRMAN. I would like to get the benefit of that study and if necessary we will authorize that. Go ahead, Dr. Templet.

Dr. TEMPLET. The expense of something else is the delta that the Mississippi River might be building. The Mississippi River is not building any deltas because we're shooting all that sediment off the edge of the continental shelf. All we're doing is regaining a lost re-

source by putting more water down the Atchafalaya. I don't see any trade off there, except maybe increase dredging or operational costs, but I think those are manageable.

The CHAIRMAN. What resources is the State prepared to put up in terms of matching funds?

Dr. TEMPLET. As you know, and you mentioned before when we started, that the State is trying to create a pot that would be at a minimum of $5 million, or if prices got to a certain level, then it would spill over and there would be more millions per year. Those monies could be used for studies to match. If we saw more Federal funds, I suspect that the State would be willing to come up with more funds of its own. But right now five is the number we're using.

The CHAIRMAN. Is there not a fund in which some serious money has been put that is for the purpose of wetlands?

Dr. TEMPLET. In the past there was. It went away when the budget problem came along about a year and a half ago.

The CHAIRMAN. The wetlands money was spent for something else?

Dr. TEMPLET. It went back to the general fund, yes.

The CHAIRMAN. So there is no fund?

Dr. TEMPLET. There is no large pot, no, that I'm aware of.

The CHAIRMAN. A small pot? If so, how much?

Dr. TEMPLET. Right now there's a few million. I would suspect seven or eight. The D & R administers it so they would probably be the people to talk about, but I understand that we have some demonstration projects going in the range of $7 million to $8 million—$10 million.

Ms. VAN SICKLE. That's a minimum of what would be deposited this year. With the oil and gas price predictions that we're getting from D & R right now, it could be upwards to $20 million to $25 million. This year it's strictly dependent upon oil and gas prices.

The CHAIRMAN. What price would the price of oil have to go to, to get to 20.

Ms. VAN SICKLE. I can't answer that question. I can get you're answer right quick if you would like though. The man from the Governor's office is outside, Dave Swallow, could answer that.

The CHAIRMAN. Well let us get that, but do not let us interrupt the hearing. But let us get that later for the record because that is important. The Caernarvon project is supposed to be 25 percent State funding and I think we have the funds to match Caernarvon at 25 percent. The question of whether we can match these other projects is a little more iffy considering the financial condition of the State. Ms. Van Sickle, do you and the Corps basically agree on that approach to wetlands?

Ms. VAN SICKLE. Looking at what the Colonel's group has come up with through their intensive study that they are doing, I just think that they're not as aggressive as we are and their cost/benefit ratio, I think, is destroying the potential for the Corps to come in and do some of these multi-million dollar projects.

The CHAIRMAN. Of course you understand that the Corps cannot do multi-million dollar projects unless authorized and the money provided. Sometimes the Corps gets blamed for not doing things

that they cannot do unless they are authorized and directed by Congress. That is what this legislation is about.

Ms. VAN SICKLE. I still have some problems with some of the things that are going on regarding the use of dredge spoil like the dredge spoil you're getting out of the Mississippi River now. It's probably going to be deposited offshore. Am I correct?

The CHAIRMAN. Most of it.

Ms. VAN SICKLE. So we're still dumping dredge spoil from our sediment "star" coast off into the Gulf of Mexico.

The CHAIRMAN. Let us give the Colonel a chance to respond to that. Why not put the dredge spoil where it belongs in the marsh?

Colonel GORSKI. I wish I had some easy answers to complex problems and questions. We are using, within our existing authorities and existing funds, Senator, we are using as much of the dredged material as we can. I hate to use the word "spoil," because I look at it as a resource. The material that comes down the river that we dredge is a resource, and we like to, as best we can, put it where it will be most beneficial. When we resuspend the sediments in our dredging, and much of what we do is to resuspend the sediments and allow the river to wash them out through the mouth, we do create a sediment flow in the Gulf of Mexico. Some of that, at least, get deposited along the shoreline. There is a littoral drift that does deposit some of it along the shoreline. What we do with the maintenance dredging, wherever we can, is to place it in a disposal area which will hold the material and build new vegetated wetlands. But it's an expensive proposition when you talk about moving that material more than a few thousand yards.

The CHAIRMAN. In other words, it is not financially feasible (economically feasible) to pump much of that over the levee into the marsh?

Colonel GORSKI. Again, Senator, there's no simple answer, but I'll give you the example: the Barataria Bay Waterway, for which we are currently in the final stages of preparation of contract specifications. We are about to let a maintenance dredging contract for the Barataria Bay Waterway. It will cost us about half a million dollars to do the maintenance dredging we are going to do. The state has asked us to place some or all of the dredged material on Queen Bess Island. The cost of transporting that material, just the cost of transporting, it would be an additional $135,000. The cost of creating some kind of confinement system, using dikes or soil filled bags, or something like that, is on the order of $450,000. So it's not a cheap process. It sometimes can be as expensive to place it as it is to dig it up.

The CHAIRMAN. Thank you. One final question. In this legislation, we provide that the Secretary of the Interior in conjunction and in consultation with the Secretary of the Army, acting through the Corps, Secretary of Commerce, Secretary of Agriculture, EPA, and then we will add the State of Louisiana, shall initiate a process to identify and prepare a list of high priority projects. I think you all have seen that mechanism to list the projects. We also provide for $10 million a year for the process of identifying those projects, really preliminary design. Much of it will be because the cost will have to be identified. Colonel, is that a workable process?

Colonel GORSKI. Senator, as you know, the Department of the Army has not taken a final position on your proposed legislation, so it would be inappropriate for me to say specifically. I will say that the President's Task Force under the Domestic Policy Council, the President's Task Force on Wetlands, will be developing a policy which we would hope would give us some guidance. We in the Corps down here in Louisiana expect it will give us some guidance on how best to do that.

The CHAIRMAN. The Secretary of the Army has testified and endorsed the general concept of the legislation. My question is not whether you endorse the legislation or whether something else can be better, but whether that mechanism, if you are familiar enough with the question, whether that is a workable mechanism?

Colonel GORSKI. Sir, again, at my level, if I am provided the funding, I can do a great deal of work. It's up to my superiors in Washington to tell you whether or not the mechanism you propose will work.

The CHAIRMAN. Dr. Templet?

Dr. TEMPLET. The State doesn't take an official position either, but I can tell you I think it will work and I like it.

The CHAIRMAN. Ms. Van Sickle, do you think it will work?

Ms. VAN SICKLE. Ditto, Dr. Templet. [Laughter.]

The CHAIRMAN. If we have not proved anything else, we have proved that this is an immensely complicated, difficult, expensive process about which people of great learning and knowledge and wisdom on the question of wetlands will disagree, because there are no final answers when you are trying to predict the course of the Mississippi River and determine how you can change it. How you can remake what God has initially made and reform it. It is sort of like trying to predict the weather, to some extent. We can, we have found, change the weather sometimes, and we can and we must, in my view, restore, enhance, and in some cases, build coastal wetlands in Louisiana.

While the mechanisms to do that, the physical structures, will have to be designed, created, contemplated and figured out over a period of time, there is no question it is going to take very serious money. That is why I think we ought to begin now by passing legislation to set aside this serious money to begin the process. That is what my bill does.

The other panel, I suspect, some of them will talk about the funding mechanism. I will tell you that two cents in MCF on natural gas, we do not want to put a fee on anything. This is interstate gas, most of which does not come to Louisiana. It is a national problem and it would be paid for on a national basis. I want to thank all of you for testifying. This will not be the last time we will think about wetlands, but this is a great leap forward I think for the process. Thank you very much.

Our next panel will be composed of Dr. Robert Thomas, Executive Director of Louisiana Nature and Science Center, Inc. in New Orleans; Dr. Paul Kemp who is Executive Director of the Coalition to Restore Coastal Louisiana, from Baton Rouge; Dr. Oliver Houck from Tulane University Law School; Dr. Jim Gosselink who is with the LSU Center for Wetlands Resources here in Baton Rouge; and

Dr. Jim Porter who is President of Mid-Continent Oil and Gas here in Baton Rouge.

Ladies and gentlemen, we have unfortunately, somewhat of a time problem in that we have five witnesses and we want to allow time for questioning, so I would urge you to, if you can, to summarize within a period of perhaps five minutes. I do not want to be too strict on the time limitations. That will give us time to have some give and take, because I do have a luncheon speech that I must make.

Let us begin with Dr. Robert Thomas.

STATEMENT OF DR. ROBERT A. THOMAS, EXECUTIVE DIRECTOR, LOUISIANA NATURE AND SCIENCE CENTER

Dr. THOMAS. Thank you, thank you for inviting me. After hearing all of the, basically the department heads speak, I'm basically going to speak from the prospective of the person who has been out there for a lot of years doing environmental education and talking with the general public. Most of my concerns are the things that I hear from the common man, the layman out there in the State that are very concerned.

I think one of the most confusing issues that we're facing is that the discussions range from, it's inevitable and there's nothing we can do about it to those who talk in terms of we're going to solve the entire problem and return Louisiana to the way it was some years ago. You can imagine what this does to the layman. They just don't quite understand; the people that don't have the technical background.

When we talked about this issue, I feel like we were talking about a societal problem of course. Yet the entire piece of land, and if I focus on Louisiana, forgive me because I'm well aware that we're talking about coastal problems nationwide. But when you focus on this land, some of it's under private ownership, it's under parcelled out public ownership, different parishes, different government agencies, and things like that. Yet it's in the vital interest of society as a whole. We're definitely at war. I mean our nation is basically at war with something that's eating away our coastline.

Yet the problem that I perceive as the largest, and I'm going to go through a handful of things. Many of which, all of which have already been said today, just to run through a few ideas that I feel are very important.

We have no captain, Senator. There is no agency, there is no person, there is no coordination to the whole project, and of course that's the thing that we all talk about. I think the beginning of the solution of a problem is when everything becomes coordinated. I know that that's where you're headed. I know that's why we formed the Coalition To Restore Coastal Louisiana in our State. I know that's why the Governor assigned a Task Force and now he's looking at his wetland czar. So we're looking at that folks, and please, I think that one of the greatest urgencies is to bring it into focus so we can set a long range plan and move forward.

One of the most awesome things that I've heard about recently, is somebody told me that the country of Japan has a 250 year long-

range plan and that maybe that's the basis for their economic success.

The CHAIRMAN. Well my legislation, you know, puts the Secretary of Interior in charge of the process.

Dr. THOMAS. Exactly, exactly. I hope it's all going to come together, I just wanted to state that.

Working out among the general public, I think (and this gets back to the thing about focusing) is that we seem to still be in a period where there's not a lot of trust. Industry doesn't trust the environmentalists. Environmentalists don't trust industry. Bureaucracies work too slowly. With all due respect to the Corps of Engineers, people over there (they're my buddies) tell me it takes 20 years to accomplish a project. So when we talk about throwing your hundreds of millions of dollars to the Corps to set up more diversions, and Dr. Templet said as many as 20. If we were doing it on the scale that the Corps does, you're talking about 40 or 50 years from now before those things are really in operation. That's a little bit scary.

I feel that we're heading towards something where there is going to be no consensus. The Secretary of the Department of the Interior and others are going to have to simply sit down and make some decisions. I know that you are well aware of that.

I want to run through just eight little quick things that I've summarized. As I have said, they've all been said, so I'll go quickly. But I feel that Congress must recognize the national importance of coastal wetlands loss. I know you do, I know there are 20 or 30 Congressionals who are extremely up on this, very aware, working very diligently to do it. But unfortunately there may be some people from Idaho that don't realize that when we lose Louisiana's coastland, they're going to lose their quality of life.

All Federal, state and local policies and regulations must be formulated on the premise of wetland losses and economic disaster. All wetland destruction by humans must be mitigated by wetland preservation or construction. I know that there are people who hate to hear that, but we're not dealing with the same issues that we dealt with 20 years ago. We can't go back and use data that's 20 years old to solve our solutions for the future.

The lower Mississippi River must be set free in order to capture it's valuable sediment before it leaves the continental shelf. Everything possible must be done to encourage growth of the Atchafalaya River Delta. That's already been discussed. The problem of canals and spoil banks must be addressed with solutions being mandated. Sediment traps should be in a more widespread fashion. We've gotten the christmas tree thing going in south Louisiana. I had a secretary of a moving company call me the other day and she said "Once a week I see a thousand wooden pallets go to the dump. Can ya'll use those in coastal restoration?" You know here's entrepreneurship coming from a secretary of a moving company. I love it.

Then to protect our barrier islands. We must do so wisely. There was some discussion today about how the Corps is looking at doing that and the cost/benefit ratios and everything else. I'm disturbed to think that they would take sand from the east end of the island, since they're moving from east to west. But somebody's got to sit

down and really come up with some Federal mandates on how that is to be controlled.

Then one final word, entrepreneurship. When we have these discussions, we always talk about Federal agencies. We always talk about different plans that can be used, but I know that you're not ignoring entrepreneurship and I just want to throw in a plug. Because the lady with the pallets, the gentleman down in New Orleans who's trying to get capital to start hybridizing vegetation that will seed more quickly, that will put out larger seed mass, etc., etc., etc., is to be encouraged. Individual plantings. There's been a lot of evidence now in south Louisiana where individuals are making a significant difference in wetlands.

I gave a talk recently to a dredging company. A guy pulled out a little calculator and started zitting around when I was talking about the amount of sediment in the River and said "For X amount of dollars we can take every speck of sediment in that River and put it out on the coastal plain." This is entrepreneurship that needs to be encouraged.

Then novel ideas. Certainly we don't want to lose those. A professor at LSU once recommended that we divert the entire Mississippi just south of New Orleans into the MRGO and solve two big problems at once.

I think these are the kind of things that sometimes when we get in these meetings we forget that the little man can really make a big difference. It is good old "yankee" ingenuity that might lead us that way. Thank you.

[The prepared statement of Dr. Thomas follows:]

COMMENTS BY ROBERT A. THOMAS BEFORE THE

UNITED STATES SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES

AUGUST 31, 1989 - BATON ROUGE, LOUISIANA

America has always been a land of plenty. Our land was blessed with a plethora of resources and escaped being inhabited by advanced civilizations until a mere 500 years ago. The abundant resources and confidence of residents that any natural impediment could be out-engineered undoubtedly provided the basis for a cornucopial attitude

It is now clearly understood that our nation's coastal wetlands must be counted among our most economically important regions. If the wetlands go, all wetland dependent businesses go. Imagine the disappearance of all commercial fisheries, boat builders, tackle factories, shotgun and ammunition producers, water ski fabricators, outboard engine specialists, canning plants, etc.

And what about all the businesses that those folks support? What about shoe salesmen, grocers, gasoline stations, home builders, bankers, barbers, school teachers, elected officials, and government employees?

It is easy to see that if the wetlands go, all the directly involved businesses go. If they go, all their support businesses go. And so on, and so forth!

As I see it, our nation is at war. We are battling an enemy that will surely devastate our lifestyles, destroy our culture, weaken our economy and, thus, place our nation at risk in the world community. The ammunition of the enemy is varied: some of the dangers are of natural origins, others are from past mistakes finally catching up with us, some are a continuing ignorance based on human arrogance, and of course there is the paucity of altruism among those who have the toys. BUT, even against these odds, believing in the American spirit as I do, there would be hope if we could solve our greatest problem: No one has united our troops. There is no charismatic, sharing leader who is trusted by all.

Too many scientists espouse only the story derived from narrowly based studies. Too many industries fiercely defend their turf. Too many elected officials seem to have personal agendas. Environmentalists don't trust big business. Many government employees spend more time making regulatory procedures complex than making them productive. Even federal agencies have vastly different philosophies arising from diverse missions. IS THERE ANY WONDER THAT WE HAVE NOT SOLVED OUR PROBLEMS?

I look to Washington for Solomon. Congress must mandate a plan of action before solutions will occur. No single entity, including the oil and gas industry, the State of Louisiana, land owners, environmentalists, the Corps of Engineers, Fish and Wildlife Service, etc., can solve a problem of this magnitude.

1. Congress must recognize the national importance of coastal wetlands loss.

2. All federal, state, and local policies and regulations must be formulated on the premise that wetland loss is an economic disaster.
3. All wetland destruction by humans must be mitigated by wetland preservation or construction.
4. The lower Mississippi River must be set free on order to capture its valuable sediment before it leaves the continental shelf.
5. Everything possible must be done to encourage growth of the Atchafalaya River delta.
6. The problem of canals and spoil banks must be addressed with solutions being mandated.
7. Sediment traps should be more wide-spread. Since we know they work, what other resources are available. Christmas trees are useful, and a secretary recently called me and suggested using cargo pallets that would otherwise fill our vanishing dumps!
8. Protect our barrier islands wisely. Do not subsidize their development, do outlaw jettys and groins that interrupt their natural evolution, and do fund planting programs.

My sense is that we are faced with inevitable changes. In our haste to "improve" our lives, we have shown our human frailty by not correctly forecasting the consequences of such major decisions as building levees to protect ourselves from floods, promoting the oxidation of organic soils by draining land, aiding salt water intrustion, building spoil banks and thus interupting the hydrology of complex marsh ecosystems,and, yes, building cities where maybe they should not be!

All finger pointing aside, we are faced with the situation as it exists. I hope that we can slow the process long enough for good ole Yankee ingenuity to replace Mother Nature's treasures that we are losing. Please be sure that your plans allow for entrepreneurship, the cornerstone of American progress.

* * *

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The CHAIRMAN. Thank you very much, Dr. Thomas. Next we have Dr. Paul Kemp, Executive Director of the Coalition to Restore Coastal Louisiana.

STATEMENT OF DR. G. PAUL KEMP, EXECUTIVE DIRECTOR, COALITION TO RESTORE COASTAL LOUISIANA

Dr. KEMP. Senator Johnston, it's certainly a pleasure to be here as the Executive Director of the Coalition. That's a non-profit group that's evolved since 1986 to include over 80 member organizations with a total membership in Louisiana estimated at more than 25,000 people.

I want to take this opportunity to present you with a petition signed by over 5,700 people in New Orleans supporting coastal restoration and a Federal commitment to the Mississippi River delta. It's our hope that you will present this petition to President Bush as he works to confect a "no net loss" wetlands policy that effectively addresses the 80 percent of coastal wetlands losses which take place within the Mississippi River delta.

As director of the Coalition, I work closely with all kinds of groups; mainstream conservation groups, Indian tribes, Chambers of Commerce. It's clear that to Louisianians, coastal restoration is a lot more than saving wetlands. It's also about a way of life and livelihoods.

Before I became a director, I was a research scientist and I got involved in this because I was asked to consult on a lot of sediment transport problems, mostly outside of Louisiana. I live in Louisiana, I spend all my time everywhere else. My own research, that of other colleagues, particularly in The Netherlands, have led me to understand that a lot of the waste of the wetlands that we see here is really preventable and can be reversed.

The technical challenges are tremendous, there's no question. But, I think it's what we kind of talked about before. It's a matter of national commitment. We do a lot of things in this country that don't necessarily cost out on a cost/benefit ratio. We put people on the moon, we do things like that. It's a matter of making the priority.

I had the honor of testifying for Senator Breaux's bill earlier this month in Washington. At that point, I had a chance to listen to some administration reaction and they were quick to point out that the President really hasn't decided how to implement his "no net loss" policy. They're concerned about the cost aspects and also about the fact that it would be targeted directly for Louisiana. We take the approach that we're talking about the Mississippi River delta, a national treasure basically. The only large deltaic land mass of its type in the U.S. It is uniquely deserving of some special treatment.

While Amendment 229 certainly goes a long way towards addressing the concerns of other states and that sort of thing, but I would caution against going too far down that road. The case for the unique treatment of the Mississippi River delta is strong both on the historical resource base and also on an environmental basis. Furthermore, the restoration of the nation's premier coastal wetland area can be accomplished, I think if we'd gotten that, at a

level expenditure. It really is going to blow up any kind of a spread-it-around everywhere kind of bill. One might be inclined to believe that a little bit is better than nothing. I would venture to say that it's not necessarily the case here. We need a substantial downpayment on re-engineering the hydrology of the delta and it's only when we get over a certain hump that smaller kinds of infusions are going to do a lot of good.

We don't know where this spending threshold actually lies, although a lot of people are working on that problem. But I think that we've got some consensus that we're talking about that your bill is on the right track in terms of hundreds of millions of dollars.

The only numbers we can really compare to the cost of restoration are the real costs of doing nothing, or of doing too little, too late. I certainly don't need to tell you that continuation of the existing policy is going to be a very expensive proposition. At a loss rate of 40 to 60 square miles per year, we are currently facing the extinction of complete parishes and counties over the next 50 years. The cost of that type of sacrifice is something that needs to be put into the equation, particularly when Louisiana is facing the kind of economic situation that it does today. So we urge you to continue to press for this national commitment to the Mississippi River delta, rather than seeking some sort of formula type accommodation.

The reason I say that is because there is a consensus growing in the national environmental community that the Mississippi River delta is a unique resource that is worth saving. There you have some important allies. All across the country we have—the membership of the coalition includes some of the large major national environmental organizations: The National Wildlife Federation, the Sierra Club, the National Audubon Environmental Defense Fund. These people are working with us very closely to build a national agreement that something needs to be done. Something special needs to be done for the Mississippi River delta.

I think that what we need to do is where there might be some tendency to try and submerge Louisiana's wetland policies in a national context, I think we ought to watch that very carefully and not lose sight of the uniqueness that we have here.

A few recommendations, if I might. Amendment 229 does not specifically address how projects will be prioritized and what cost-share arrangements will be proposed, leaving that for the Secretary of the Interior to really develop. My understanding is that, and I understand the State will now be involved more, and that's important, as a practical matter, in order to really get the national environmental community to endorse this approach, I think that there needs to be more work on exactly how that prioritization will take place. And if it's done properly, that we get a lot of support.

Also, I think that we need to change the mandate of the Corps to bring it in line with the shift in current needs from exclusively navigation and flood control toward environmental engineering and habitat restoration. The history of the Kissimmee River project, for example, which was started so successfully by the State of Florida in 1984, is one of the Corps really not being willing to accept the mandate of habitat restoration. It should be pointed out that if it is funded in the appropriation process this year, this other

project in Florida will proceed on the basis of what it does for the Everglades, a wetlands area second only to the Mississippi River delta in terms of area and resource value. While it will be far less costly than the projects we envision for the delta, the Kissimmee River project could be important proof that it is politically possible to restore valuable and unique wetland systems based on their own merit, rather than on some arbitrary national formula. The Coalition strongly endorses the creative funding approaches envisioned in this bill and we look forward to working with you to pass legislation on this kind of scale. I thank you for this opportunity.

[The prepared statement of Dr. Kemp follows:]

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Amendment 229 to Senate Bill 406
Establishment of a Wetlands Protection, Restoration and Enhancement Account

Field Hearing by the
Committee on Energy and Natural Resources
United States Senate

Baton Rouge, Louisiana
August 31, 1989

Testimony of
G. Paul Kemp, Executive Director
Coalition to Restore Coastal Louisiana

Mr. Chairman, I am Dr. Paul Kemp, the Executive Director of the Coalition to Restore Coastal Louisiana, a non-profit citizens' coalition which has evolved since 1986 to include over 80 organizations with a total membership in Louisiana of more than 25,000 people. The Coalition's mission is to mobilize action at the local, state and federal levels, to protect and restore Louisiana's coastal wetlands, before it is too late. We are honored to have been asked to testify here today. We strongly support the initiative embodied in Amendment 229 and would like to present to you the names of 5700 people from all over the U.S. and from many other countries who signed a petition this summer in New Orleans in support of a Federal commitment to the restoration of the Mississippi River delta. It is our hope that you will present this petition to President Bush as he works to confect a "no net loss" wetlands policy that addresses the 80% of coastal wetlands losses which take place within the Mississippi River delta.

As director of the Coalition, I work closely with the mainstream conservation organizations, both national and local, but I also respond to the input I receive from other Coalition members, including churches, chambers of commerce, civics groups, businesses, Native Americans, villages and trade unions all across South Louisiana. To Louisianians, clearly, restoration of the Mississippi delta is about more than saving wetlands, it is also about preserving a way of life, and livelihoods.

Prior to becoming director, I was a research scientist and a consultant to industry and government on fine-grained sediment, or mud, transport and deposition by waves and currents. My own research, and that of colleagues in The Netherlands, have led me to understand that the current waste of wetlands in Louisiana is both unnecessary and, to some degree, reversible.

The technical challenges are significant, but they are surmountable if this Nation, as a whole, declares that the Mississippi River delta, including its wetlands, its culture and its renewable resources are worth saving. Because it is a National treasure, the equal of the Everglades or the Grand Canyon, which is at stake. In simplest terms, Amendment 229 and Senate Bill 630 introduced earlier this year by Senator Breaux are such declarations. Passage of this bill will at once put flesh on the presently undefined skeleton of national wetlands policy by addressing in a substantive way that 40% of the Nation's coastal wetlands which is experiencing the most deterioration -- the 5,000 square miles of the Mississippi River delta.

Last month, the Louisiana legislature passed new laws which commit the State to dedicate up to $25 million per year of mineral revenues for coastal restoration. Furthermore, it is significant that Louisiana's first statewide referendum on the environment, a constitutional amendment to appear on the ballot this October, is an initiative to ensure that funding for wetlands restoration is secure and well-spent. It's chances for passage are excellent. Louisiana is now ready to do its share.

I had the honor of testifying for S630 earlier this month in Washington. I also listened carefully to the testimony of the agency people charged with articulating the views of the Administration, or at least of the Office of Management and Budget, with regard to restoration of the Mississippi River delta. While they were quick to point out that the Administration has not yet decided how to implement the "no net loss" wetlands policy endorsed by the President, they did express concern about any bill which addresses wetlands only in Louisiana or which bypasses normal budgetary processes by tagging OCS revenues annually on a percentage basis.

While Amendment 229 goes some distance in addressing these predictable criticisms, I would caution against going too far in the future to accomodate these views. The case for unique treatment of the Mississippi River delta is strong both on an historical resource basis and on an environmental basis. Furthermore, restoration of the Nation's premier coastal wetland area can be accomplished only at a level of expenditure which will be beyond the resources of any spread-it-around generic wetlands bill. One may be inclined to believe that a little bit is better than nothing. But the sad truth here is that only when a substantial downpayment is made on re-engineering the hydrology of the delta will incremental lower-cost measures buy more than a little time.

We do not know exactly where this spending threshold lies, although many technical people both inside and outside of the Army Corps are currently working on answers to this important question. The numbers that our scientists and engineers have developed suggest that it will be on the order of hundreds of millions of dollars.

The only numbers we can compare with the costs of restoration are the real costs of doing nothing, or of doing too little, too late. I certainly don't need to tell you that continuation of existing policy will be very expensive indeed. At a loss rate of 50 to 60 square miles per year, we are currently facing the extinction of complete parishes (counties) over the next 50 years. The costs of sacrificing the existing investment in cities, towns, natural resources, industries, jobs, flood control and navigation structures, and so on, would be counted in the billions, and leave Louisiana in irreversible economic decline. We would therefore urge you to continue to press for a national commitment to the delta, rather than seeking some accomodation which will not do the job.

A consensus is developing in the national environmental community that the Mississippi River delta is a national treasure, deserving of a substantive national commitment. As I speak before you here today, I bring a message to you from several of Nation's largest and most active environmental organizations, which also happen to be member organizations of the Coalition, including the National Wildlife Federation, the National Audubon Society, the Sierra Club and the Environmental Defense Fund, to name only a few. These organizations will actively support a national commitment to Mississippi River delta, provided that safeguards in the 1986 law governing water projects are substantively addressed.

A few recommendations. Amendment 229 does not specifically address how projects will be prioritized, or what cost-sharing arrangements will be proposed, leaving that for the Secretary's of the Interior and Army to develop. My understanding is that the bill will be amended to include a substantive role for the State. This is important. As a practical matter, we believe that it will also be necessary to define this prioritization process in more detail, perhaps along the lines laid out in S630, in order to win national support from the environmentalcommunity.

Overall, we believe that Amendment 229 could be more effective if it directly addressed the need to change the mandate of the Army Corps to bring it into line with the shift in current needs from exclusively navigation and flood control toward environmental engineering and habitat restoration. For the past several years, for example, the Corps has balked, despite Congressional directives, at spending appropriated monies to complete the Kissimmee River Restoration begun with such success by the State of Florida in 1984. It is important that this project go forward this year as it sets a precedent for federal involvement in wetlands restoration. It should be pointed out that if it is funded in the appropriation process this year, restoration will proceed on the basis of what it does for the Everglades, a wetlands area second only to that of the Mississippi River delta in terms of area and resource value. While it will be far less costly than the projects we envision for the delta, the Kissimmee River project could be important proof that it is politically possible to restore valuable and unique wetland systems based on their own merit, rather than on some arbitrarynationalformula.

In the remainder of my testimony, I would like to draw attention to three reasons why a wetland bill like Amendment 229 which focuses on the Mississippi River delta, and which derives funding from a new Outer Continental Shelf (OCS) revenue stream should receive Congressional support. These are,

- first, that the Mississippi River delta is a unique wetland land mass, set apart from all other ecological systems in the Nation by its distinctive geology, habitat value, and economicproductivity;

- second, that the land-loss problem in the Mississippi River delta is more intimately associated with projects and activities conducted for national purposes, namely navigation and low-cost oil and gas exploration and development, than is true for any other threatened wetland area; and

- finally, that the solutions to land-loss in the Mississippi River delta will be unique in the degree to which they will make use of the largest sediment carrying river in North America.

WHAT IS AT RISK

We now know that 50 square miles of the Nation's most productive wetlands turn into open water each year along Louisiana's coast. That is approximately four acres an hour. But it happens foot by foot, yard by yard, spread across a wetland area of approximately 5,000 square miles. Somehow, the incremental nature of the loss at any one location conceals the magnitude of the problem as a whole.

More important than the statistics on the acreage lost, however, is the fact that a much larger area of habitat is being modified and degraded than is actually being lost in any given year. Each of the 5,000 square miles of Louisiana's coastal wetlands is affected. Salt meadows once protected by barrier islands are now exposed to significant wave action.

Fragile, floating freshwater marshes are affected for the first time by salt water. And yes, towns and cities which once were buffered from the hurricane waves of the Gulf of Mexico by the damping action of miles of marsh are now protected only by levees of questionable adequacy.

What do we stand to lose -- can we afford to lose? The resources of this unique coastal landscape, the largest active river delta in North America, are of unparalleled value.

According to the National Marine Fisheries Service, about 28% of the commercial fisheries volume landed in the United States is dependent upon the wetlands of the Mississippi River delta. When only those species of finfish and shellfish are considered which spend at least some part of their lives in coastal waters, the contribution of the Mississippi River delta to fisheries volume is proportionately larger, nearly 50%.

Fisheries production is only one measure of the contribution of the Mississippi River delta, which each of us savors as we eat shrimp, crab, oysters and many types of finfish in restaurants all across America, even here on the banks of the Chesapeake Bay. Similar testimony to the immense biological productivity of this unique landscape can be derived from statistics on fur production, where Louisiana also leads the Nation, and on the numbers of migratory waterfowl, over 50% of the North American total, which use Louisiana's wetlands as the southern terminus of the Mississippi Flyway.

It is estimated that Louisiana's wetlands support a total economic activity associated with the combined recreational and commercial fisheries which is on the order of a billion dollars a year. Current National Marine Fisheries Service predictions are for a dramatic reduction in yield to begin within the 1990's if the deterioration of coastal wetland nursery grounds in Louisiana is not slowed. The same conclusions may reasonably be extrapolated to the other wildlife dependent on the wetlands. It is a common irony of nature that harvested populations tend not to disappear slowly, but more often suddenly, as some critical part of their life cycle is affected irreversibly by a reduction in numbers or by habitat destruction. It is this tragedy that we are here today to prevent.

THE CAUSES

We are told by some that the natural process of subsidence, coupled with the new threat posed by greenhouse-related sea level rise, must inevitably spell the end for the wetlands of the Mississippi River delta. This argument ignores first, the unique natural ability of wetlands to adapt to sea level changes by growing upward if supplied with sufficient sediment, and, second, the rapidity with which the wetlands have responded negatively to human modifications of delta hydrology in this century. The unprecedented rate of land loss over the past 40 years is a clue that man's activities do make a difference. and, by the same token, that corrective measures might also have swift ameliorative effects.

What have we done to the delta? First, we have virtually isolated it from the River. The Mississippi and its daughter, the Atchafalaya, have been leveed virtually to their mouths for flood control and navigation purposes. While the 30% of flow which is permitted down the Atchafalaya is slowly building land in the shallows of Atchafalaya Bay, all of the sediment passing down the main stem is lost from the coastal system and shunted off the continental shelf to water depths in excess of a thousand feet. It is now as true in Louisiana, as it is along the Nile, that annual infusions of sediment and freshwater are required in delta systems, not only for the construction of land, but also for its maintenance. The Mississippi River delta has been subjected to sediment starvation for most of this century, and the patient is failing fast.

Secondly, we have constructed approximately 8,000 miles of canals through the wetlands of the delta primarily to facilitate low-cost oil and gas extraction. These canals come in a variety of sizes, ranging from major shipping and navigation arteries, to access canals dredged to accomodate drilling barges, to cuts made for pipelines, large and small. They, along with the accompanying spoil banks, were constructed without consideration of the natural flow of water through the wetland basins, and so have accelerated land-loss by breaching barrier islands and natural levee ridges, while at the same time isolating other areas from contact with the rest of the estuary.

Increasingly, new canals have been associated with the movement of the industry offshore into the OCS. The rich mineral resources of this frontier, which typically generates more than 60% of all the total offshore mineral revenues received by the U.S. Treasury, must traverse Louisiana's wetlands to reach consumers all over the country. Future development of the OCS offshore industry means that pressure to dredge new canals through the Mississippi delta will persist, while the old ones, now virtually abandoned by the industry, continue to enlarge uncontrollably and negatively affect the hydrology and ecology.

THE SOLUTIONS

Louisiana and Louisianians have enjoyed numerous benefits from the largely Federal expenditures for flood control and navigation, and from private oil and gas extraction activities conducted in the National interest. It is becoming clear, however, that the incidental consequence of management of the Mississippi River delta for these purposes alone amounts to a **de facto** management for maximum wetland loss.

Right now, for example, the state is locked in a struggle with the New Orleans District of the Corps of Engineers which is symptomatic of the larger problem. The question is whether sediments dredged from coastal channels and passes should be used beneficially to restore nearby barrier islands or disposed of in deep waters offshore. The Corps argues that the incremental benefits which regulations allow it to assign to restoring coastal barriers and the wetlands they protect are not sufficient to justify altering their plans to certainly waste this material offshore. We would argue -- and Amendment 229 should mandate -- that such rules be changed.

The Mississippi/Atchafalaya River system is today the fifth largest sediment carrying river in the world. Significant diversion of sediment and water from these Rivers during high water periods through a conduit network consisting of open channels and pipelines similar to those used for irrigation in the West could potentially do much to reverse the destruction of the Mississippi delta without compromising flood control and navigation missions. Even more would be possible if an alternative navigation outlet could be developed which would reduce the dependence of the Corps on focusing scour to keep the navigation channel open at the river mouth.

There are those who argue that there is not enough sediment available to do the job. It is true that the Mississippi carried twice as much sediment in the 1930's and 40's, when reliable estimates were first made, than it does today. But it must be remembered that these early high estimates of sediment load reflect the opening of the Midwest to agriculture and the development of the dust bowl phenomenon. Virtually all of the present delta land mass was built when the River carried a far lower load -- probably comparable to that of today -- prior to deforestation and the arrival of Europeans in the Mississippi drainage.

Proactive efforts to harness the River for coastal restoration must inevitably be the cornerstone of any long-term plan to preserve the Mississippi River delta. In this context only, will the myriad and well-motivated other localized efforts to enhance sedimentation,

to restore damaged wetlands by backfilling canals and removing spoil banks and to stabilize coastal barriers stand a chance of success.

Furthermore, once a substantive National commitment has been made to the delta, then it will be reasonable to ask that Louisianians, in return, protect this investment through imposition of tighter regulatory controls on wetland development activities.

CONCLUSION

The past two decades have witnessed development of a two-faced federal approach to wetlands in Louisiana. At the same time that direct or indirect Federal actions have hastened the loss of all land in the delta, the Federal government has asked individuals and local governments to limit severely uses of wetlands for anything but oil and gas development.

The achievement of a goal of no net loss of coastal wetlands in Louisiana challenges our scientific and technological capabilities as well as our political will and financial resources. The goal of no net loss due to development activities can, in contrast, be achieved quite rapidly if Louisianians believe that the delta has a future, and that they are not being abandoned by the rest of the Nation to face the advance of the sea alone.

Finally, we have limited our comments with respect to the details of Amendment 229 primarily because we find the overall approach so refreshing, pragmatic and appropriate. We believe, however, that certain provisions of the bill should be spelled out in more detail.

First, we support a very strong role indeed for the EPA in ensuring public input and in certifying that restoration efforts in Louisiana are environmentally sound and enjoy widespread public support outside of the State. For the same reasons, we would also like to see additional assurances in the bill that any Federal funds used in the coastal restoration effort will not be spent to offset future losses to development activities. We recognize that a need will arise for mitigation or action to fully compensate for wetland destruction due to development by private interests, and our concern is that these efforts be undertaken and funded separately by the benefited parties as an addition to any effort using federal funds.

I hope that I have answered some of the questions that you may have about why Congress should approve an Amendment specifically focused on the conservation and restoration of Louisiana's coastal wetlands. Frankly, we in the Coalition who have witnessed the rate of change so personally do not feel that we can afford to wait for the slow process of developing generally applicable legislation to unfold with all the attendant interaction of so many disparate and competing interests. For this reason, as well as the clear National interest in the Mississippi River delta, I urge that you work closely with the national environmental community to improve on an admirable start, and that you exert the necessary leadership to move it toward swift passage. Technologies developed in Louisiana will then be available for application in other coastal areas, when, as the scientists tell us with certainty, these locations are confronted in the future with a problem as severe as that facing Louisiana today. Thank you for your attention.

The CHAIRMAN. Thank you very much indeed, Dr. Kemp. Next we are pleased to have Dr. Oliver Houck, expert on coastal wetlands.

STATEMENT OF DR. OLIVER A. HOUCK, PROFESSOR OF LAW, TULANE UNIVERSITY

Dr. HOUCK. Thank you, Senator, for that flattering, if only half accurate introduction.

I'm truly heartened by the focus of this hearing which is how to spend money on coastal restoration. For so many years we've been trying to simply discuss the nature and to prove the problem. As daunting as this prospect is, it's at least heartening to see that we're this far down the road.

I'd like to say two things. First, that I think your bill lays the bill for coastal restoration, or at least this component of it, at the right door. We're already spending millions of dollars in public taxpayer money, through the Corps of Engineers, Fish and Wildlife Service, and other Federal and state agencies, on these public works projects that you have discussed. But there's another player in this game that's been in it for decades that has yet to really ante up and join the table and pay its dues. And that is oil and gas extraction. The studies are legioned by virtually every name in wetlands science in Louisiana and outside of Louisiana. Day, Turner, Gosselink, Gagliano, Craig; name them. They are all coming up with conclusions that oil and gas is a major, major player. Perhaps one of the largest players in coastal losses. That fact is documented, among other places, in the 1983 study that I labored over and I produce for your committee and it's attached as an excerpt to this testimony. I won't repeat it today, but I do want to start with the predicate that unless oil and gas pays its dues, we're going to be missing a major contribution to what needs to be done.

As for now though, the happy part. What do we spend the money on? I'd like to observe that we're not starting with a blank sheet here. The Corps and the State have come up with a menu of essentially structural freshwater diversion projects which could cost a lot of money. Of those, Caernarvon is the most deserving and is underway as you know. Davis Pond is the one that has to go next. If I were you and others, I would take a hard look, and a second look at Bonnet Carre in terms of its costs and its benefits and its impact indeed on Lake Pontchartrain.

I'd also like to observe that in order to get these projects funded, I consider the 25 percent State cost-share to be unfounded and unwarranted. The reason for these diversions is to offset the impacts of the levees on the River that have created much of the problem in the first place. This is classic mitigation for a Federal responsibility that was 100 percent Federal funded initially. Under that scenario, this should be a 100 percent federal cost.

I've lost that argument before, I may lose it again, but I think there is an excellent case that this is hundred percent money. I know that politically that may not be feasible, but I wanted it in your record. Elsewhere in the country the Federal government is

paying 100 percent for restoration of salmon fisheries on the Columbia and other Federal projects.

The CHAIRMAN. My bill envisions 100 percent Federal. That is what it is all about.

Dr. HOUCK. Yes, sir. I'm talking about the funding for these other projects and existing freshwater diversions. Having said that, I think both the State and the Federal government continue to think too small in terms of what's needed to be done here.

I'm dismayed by the attitude of we can't get there from here, Mother Nature is swallowing us up, that I've heard from some quarters and I've heard again today. I think we ought to follow the Corps motto "essayons", which is on their shield, "Let us try", and I think that motto can take us a long way.

To misinterpret Ms. Van Sickle's presentation as a story of how natural it is for the coast to erode, overlooks the bottom line, which is, for all that low building and low lope losing, we have gained five million acres of what is south Louisiana today. Naturally speaking, all the processes work for gain. The reason we're losing is because of the levees and the canals. Those are man's intrusion and their up for us to offset. Now to offset them we need to think bigger than freshwater diversion. It's just too small. Putting freshwater out there doesn't grow back Louisiana marsh. It simply offsets salinity. So we need to think about sediment diversions of major scales. Scales beyond those that we've thought of yet. Indeed we need sediment diversion projects, not freshwater diversion projects. We are going to need an accompaniment to that, people diversion projects. Now that may be almost unthinkable. I remember a hearing you opened here on the Old River Control Structure ten years ago and you said "We're here today to think the unthinkable. The loss of the Mississippi down the Atchafalaya." Well, it's time to think the unthinkable again. Not only in terms of that diversion, but also in terms of the people moving. That getting the Mississippi River back out down, for example, Bayou Lafourche and other prior distributaries will mean, and that bullet needs to be bit. We also need to have a little taboo diversion, and let me suggest a few taboos that are standing in the way of erosion control in south Louisiana. These go beyond structural. What you have is a fairly complete structural menu from the State.

The comments I'm going to finish here with are comments that go to non-structural necessary measures. One is maintenance dredging. The taboo in maintenance dredging is the Corps' rigid adherence to a benefit/cost ratio imposed by the Office of Management and Budget, which means that their not going to use that dredge spoil material to build marsh unless they can find some benefiting fish production or something else for it. Now, in the Water Resources Act of 1986, you directed them away from that. They're not bound by cost/benefit ratio in this. This is a self-imposed or administration imposed requirement. I think it's illegal.

The CHAIRMAN. On page seven of my bill the following is stated.

Dr. HOUCK. I read that, sir.

The CHAIRMAN. For the benefit of the crowd, "Where such a determination is required under applicable law, benefits of projects on the list are deemed to be at least equal to the cost associated

with such projects." So the benefit/cost ratio is deemed to be solved by the passage of the legislation.

Dr. HOUCK. Hear, hear. Maybe when they read it the second time, they'll believe it because the first time it's in the 1986 act. I will say that in terms of the size of this, we're talking about 60 million cubic yards of maintenance dredging pumped out into the open water. Less than 20 percent (indeed less than 19 percent) of that dredged spoil is now used for marsh management. 80 plus percent is kicked out as waste and that's more wasteful than we can afford.

Another bullet for you is canal restoration. No one can overfly the coastal zone and simply look down from the plane and think about restoring the coast without restoring the canals. So far the offense consists of a few plugs at the mouths of the canals which eventually erode away as they're used by barters or as natural erosion widens the canal around where the plug was originally put.

Plugs doesn't cut it. We're going to need to develop an offense to refill those canals. There are backfilling studies that show that refilling is beneficial and doable. Those studies are resisted to the death by oil and gas industry and indeed some state agencies. We're going to have to use some Federal monies to pilot and demonstrate and show that backfilling can be done.

Similarly with alternative access. It's a little crazy to talk about restoring a resource if we're continuing to cut up for new access to oil and gas canals. This is crazy. Particularly when technologies are available to access oil and gas sites by air cushion vehicles (helicopters) that are being employed freely in Alaska and elsewhere. Not freely, I take that back. Expensively. But if there is a deficit here in piloting that in Louisiana, let's have a Federal match with a little private entrepreneurship and get some of these alternative access ideas involved.

We also need a new regulatory philosophy on cutting up the coastal zone. "No net loss" doesn't work in Louisiana. As positive as that phrase sounds, Louisiana's status quo is loss. Keeping up with a status quo by a one for one replacement of what you've taken just keeps us at pace with losing. We need a net gain policy in Louisiana. Anything that can't be avoided needs about a five to one offset because the offsets are experimental and because the rate of loss is so catastrophic.

In my testimony, I've also eluded to three other potential necessary uses of these monies that I'll not detail now. One is Federal assistance in marsh management that insures public access to federally assisted areas which is the bone of contention with marsh management.

The second is Federal assisted and means of curbing pollution discharges of brines and drilling muds that are presently going into the open estuaries we're trying to save.

The third is Federal assistance in community pollution for the communities around these estuarian areas, particularly those around Lake Pontchartrain whose runoff is killing that Lake and other major estuaries and which is going to need major Federal assistance toward a construction of treatment. Works which can be natural treatment systems restoring wetlands for the purposes of wetlands—water treatment, the best of both worlds.

With these bullets there are a lot of good uses for these monies. We hope you can direct them in that direction and we stand ready to help you in any way we can.

[The prepared statement of Dr. Houck follows:]

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Testimony of Oliver A. Houck before the Senate Committee on Energy and National Resources concerning Senate Amendment No. 229, August 31, 1989

Senate Amendment No. 229 responds to a national tragedy. Without the priority funding of coastal projects that it provides, America stands to lose its remaining coastal wetlands. The current rate of this loss is staggering. The Louisiana coast, comprising one quarter of the national inventory, is going down like the Titanic at sixty square miles a year. The wetlands of most coastal states, such as California and Florida, have been reduced to small fragments of their original size. To stem the tide of these losses we have, as a nation, a handful of ineffective planning, permitting and local funding programs. We have no national commitment to save the coast.

My name is Oliver Houck and I am currently a professor of law at Tulane University in New Orleans, Louisiana. I served for ten years as General Counsel to the National Wildlife Federation, and I have been directly involved in research, education, legislation and litigation on coastal zones for the past 15 years. A 1983 study, "Land Loss in

Coastal Louisiana," 58 Tulane Law Review 24-74 (1983), details the role of oil and gas development in coastal erosion; a 1988 study, "Ending the War: A Strategy to Save America's Coastal Zone" 47 Maryland Law Review 358-405, presents a strategy to save the national coastline. Today, we are focused on Amendment No. 229 and I would like to state (1) that this legislation places the bill for coastal restoration at the correct door, and (2) that there are urgent projects in Louisiana to which this funding can be applied.

1. Paying the bill. It is now beyond cavil that oil and gas development -- despite its considerable benefits -- has played a major role in coastal land loss. Studies of the exact contribution of oil and gas development attribute as little as 25 percent (largely oil and gas sponsored research) and as much as 90 percent (Turner et al, LSU) of Louisiana coastal losses to oil and gas pipeline, access and navigation canals. The impact of these canals -- constituting a 10,000 mile network through the Louisiana marshes -- is difficult to comprehend. They have, literally, cut the living marshes into pieces, isolated some pieces and inundated others, eliminated subsurface and overbank flows, and introduced wave action and corrosive salt water. Each of these effects is harmful enough; cumulatively, they have proven to be devastating. Worse yet, they are permanent and growing. The canals erode laterally at a rate that doubles in ten years, and then doubles again.

These are the rates of cancer. These are the problems, until recently largely unrecognized, created by the tradeoff we have made for oil and gas development. They need remedies.

2. Spending the bill. Amendment 229 establishes a priority system for finding restoration projects. Several freshwater diversion projects in coastal Louisiana have been studied, developed and are ready to go. They feature structures to allow the Mississippi River to re-supply coastal areas with fresh water and nutrients. This testimony offers suggestions on additionally needed projects.

a. Sediment diversion. Freshwater diversion is not a whole remedy. Offsetting salinity is an important goal, but for the long-term prospects of the coast, we will need to divert sediment as well. The largest transporter of sediments is the Mississippi River, which is still designed to jettison its silt loads off of the Continental Shelf. Until a means is devised to direct these loads back into the business of land building, we will be condemned to a losing battle of attrition. We are discarding too much to win.

b. Maintenance dredging. The Corps of Engineers additionally discards nearly sixty million cubic yards of dredged material (euphemistically called "spoil") into open water. Less than 20 percent of Corps "spoil" is used to create new marsh and to restore existing marshlands. Although the Corps is authorized by recent legislation to

use its dredged materials more productively, the cheaper options -- disposal as waste by spray hoses and even barges -- continue to prevail. And will prevail until moneys are available to make the difference.

c. Canal restoration. Despite an enormous web of open canals across the Louisiana coastal zone, eroding like open wounds, the technology for restoring these canals is in its infancy. Worse, it seems to be resisted in Louisiana, particularly by those oil and gas interests that, once the technologies proved viable, would have to pay the bill. Simple studies on backfilling existing canals -- studies that showed backfilling to have considerable promise in the tested areas -- were killed by opposition from oil and gas interests and the Louisiana Department of Wildlife and Fisheries. As one, brief overflight will convince anyone who happens to look down from the plane, there is simply no way to restore these coastal areas until we restore the canals. We need pilot restoration projects, including backfilling, on an urgent basis.

d. Alternative access. While we are all talking about restoration, the oil and gas industry remains active, although not so active as it once was, in coastal development that destroys more coastland. This development, onshore and off, continues to run pipelines and crew boats through old and new canals. A number of recent studies have documented the feasibility of over-terrain vehicles, and specifically, hovercraft, for this development (See e.g.

Sikoura). The oil and gas industry, which employs this access technology elsewhere, will not agree to do so in Louisiana of its own accord. We need an incentive from the federal government, through matching funds or otherwise, to arrive at a partnership that makes alternative access the primary access for oil and gas development, and phases out the construction of new access canals.

e. Pollution discharges. The economics of oil and gas development in Southern Louisiana have led to the discharges of its drilling muds, and formidable amounts of extracted brines, into coastal estuaries. The muds may be highly toxic. The brines are orders of magnitude more saline than their receiving waters. Once again, the industry needs the encouragement of federal assistance, coupled with a strong regulatory program, to develop disposal methods by alternative means.

f. Innovative treatment of runoff. A secondary effect of oil and gas development has been the establishment of small and large communities throughout South Louisiana whose municipal runoff leads directly to coastal waters. The discharges from Jefferson and New Orleans parishes, for example, constitute one of the larger river systems in the world. These discharges are highly polluted, and have led to the pollution of such important coastal estuaries as Lake Pontchartrain, one of the largest lakes in America, now closed to human contact recreation. Treatment of this runoff would call for almost insurmountable feats of

engineering, were they to be processed by conventional treatment works. Alternative treatment may be available through natural wetland systems, restoring the lost wetlands of near shore areas and receiving the benefits of their natural purification functions. These treatment systems may be cheaper than conventional systems by a factor of ten, but they will still cost money in a region where the oil and gas dollar has shrunk and new dollars are not abundant. The federal government has the opportunity to research, demonstrate, and assist in the construction of needed restoration projects here that serve the dual purposes of restoration and pollution control.

I hope that these ideas provide food for thought. At the very least I hope that they indicate the range of work to be done, and the need for federal assistance, such as that in amendment 229, to provide it.

Attachments: Excerpt, Houck, "Land Loss in Central Louisiana"

Excerpt, Sikoura, "Air Cushion Vehicles"

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SYMPOSIUM ON LAND LOSS IN THE LOUISIANA COASTAL ZONE

LAND LOSS IN COASTAL LOUISIANA: CAUSES, CONSEQUENCES, AND REMEDIES — Oliver A. Houck

THE CONSTITUTIONALITY OF STATE ENVIRONMENTAL TAXES — Richard J. Pierce, Jr.

CONSTITUTIONAL AND POLICY IMPLICATIONS OF LOUISIANA'S PROPOSED ENVIRONMENTAL ENERGY TAX: POLITICAL EXPEDIENCY OR EFFECTIVE REGULATION? — Ernest L. Edwards, Deborah F. Zehner, B. Richard Moore, Jr.

COMMENTS

Cooperative Federalism and Environmental Protection: The Surface Mining Control and Reclamation Act of 1977

Beware! The Commodatum Lurks

sion since 1913.[83] This history notwithstanding, subsidence along the Louisiana coast was only a modest phenomemon until the mid-1950's. Almost two-thirds of the subsidence has occurred in an escalating pattern since that time.[84] An obvious question then becomes what else has occurred in the Louisiana coastal zone that corresponds to this accelerated collapse?

For a clue, one can refer back to the conclusions of Dr. Gagliano, of the Louisiana Legislature, and of the Army Corps of Engineers just cited. Each statement couples the impact of the levees with the impact of another activity: canals, pipelines, and oil and gas extraction.

C. Canals, Pipelines, and Associated Oil and Gas Activities

Awareness of the impact of canals, pipelines, and associated oil and gas activities on the Louisiana coast has been late in coming. A single dramatic cause is easier to identify (and perhaps easier to remedy) than are the more numerous smaller causes that quietly accumulate. Evidence on the tens of thousands of access channels, navigation canals, pipeline ditches, spoil banks, borrow pits, levees, and subsurface extractions and their associated pollution indicates with increasing certainty that, while the Mississippi River levees have severely interrupted the flow of life to the Louisiana coast, these individual interferences are having an equally direct and perhaps more destructive effect on the corpus.

It is also easier to think in terms of single causes than in terms of myriad smaller ones when we underestimate the size of the smaller actions and the ways in which they work. Perhaps the most significant new information that is arriving on this subject shows that the secondary effects of these canals, channels, pipelines, and their associated work cause greater losses through erosion, intrusion, and subsidence than the original work itself.[85] The implications of these studies are sobering. They point to continuing, *accelerating* rates of subsidence in the future. These studies also correlate with, and help explain, the dramatically increasing rates of land loss on the southern coast.

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83. The occasion was the flood of 1927.
84. *See supra* note 44 and accompanying text.
85. *See infra* note 133 and accompanying text.

Oil and gas production has not always been the dominant activity on the Louisiana coastline, and man's impacts long predate its arrival. Early trappers dragged "trainasses" for their pirogues through the marsh. Loggers built "boat roads" through the cypress swamp to float timber to the mills. The more northern coastal marshes, particularly to the west, have seen drainage, pumping, and levees for agriculture and residential development,[86] and all of the southern parishes have mounted drainage campaigns for mosquito control. The dominant fact in Louisiana's recent history, however, is that a staggering wealth of nonrenewable petroleum resources underlies the more than five million acres of land, marsh, and open water of its coastal zone. The interests that seek to develop these resources must contend with the fact that 3.3 million of these acres are under water, more than half of which is less than six feet deep.[87]

The brief history that follows is a useful prelude to an understanding of the "canalization" of the coastal zone. The discussion will then address the technology of present-day canal dredging, the individual effects these works have on coastal ecosystems, the related effects of extraction and pollution, and a summary of these effects as a whole.

1. An Historical Perspective: Opening the Zone

> Successful operation of the submersible drilling barge and excavation of canals with barge mounted draglines, bucket and suction dredges, opened the coastal zone to petroleum development. . . . Their location has made the petroleum industry the greatest wetland canal builder. . . . Louisiana's coastal plan [sic] is dominated by a massive system of man-made canals. The addition of new channels is a continuous process, but no effort is made to fill in the old ones. When a canal is cut, it often becomes a permanent feature.[88]

The dredging and ditching of Louisiana's coastal marshes

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86. Gosselink, Bahr, Byrne & McIntire, *Man's Impact on the Chenier Plain of Louisiana and Texas*, in PROCEEDINGS OF THE THIRD COASTAL MARSH AND ESTUARY MANAGEMENT SYMPOSIUM 373 (J. Day, D. Culley, R. Turner & A. Mumphrey eds. 1978).

87. Louisiana Dep't of Wildlife & Fisheries Application to U.S. Dep't of Commerce, N.O.A.A., Office of C.Z.M. (1978).

88. D. Davis, Louisiana Canals and Their Influence on Wetland Development 125-27 (1973) (unpublished Ph.D. dissertation available in the Louisiana State University Library).

began early in the 1700's when French settlers began to drain agricultural land.[89] From those first few canals a network of canal systems has evolved which was estimated in 1970 to encompass over 4,500 miles,[90] and which has probably doubled since that time. The great majority of this mileage has been constructed within the past forty years to serve oil and gas production.[91] Since prior to 1948 there were no regulations requiring monitoring or permitting of dredging operations in the coastal zone,[92] the magnitude of dredging prior to that time must be gathered from informal sources.

The first canals served agricultural production, and were soon enlarged to communication links between isolated farms and settlements. By 1850 canal construction was commonplace with private landowners seeking to increase their holdings, decrease mosquito breeding grounds, and expand transportation. Since most drainage canals flowed from north to south following the gradient of the land, new east-west canals were constructed to facilitate cross-state travel and an increasing commercial trade. Around 1850 timber operators brought canals to the swamps of the coastal zone to begin the logging of cypress and bottomland hardwood stands. Many of these excavations straightened, intersected, and paralleled existing bayous and have subsequently become the dominant courses of the natural drainage system.[93] When in 1914 fur prices rose to a highly profitable level, the smaller "trainasses" multiplied on the landscape;[94] trappers and hunters simply pushed their pirogues through the vegetation, providing narrow paths to their traps and blinds. Without the association of spoil banks and dredged material, the trainasses have left only thin scars on the surface

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89. *Id.* at 39. Much of the pre-1936 discussion of canals which follows is also drawn from this source.

90. G. ADKINS & P. BOWMAN, A STUDY OF THE FAUNA IN DREDGED CANALS OF COASTAL LOUISIANA 67 (Technical Bull. No. 18, Feb. 1976).

91. From humble beginnings in the mid 1700s, when a farmer dug a canal by hand to drain a piece of land, canal dredging has increased at an unchecked rate until today there are more than 4,572 miles of canals in coastal Louisiana. . . . These canals are used for a variety of purposes; however a vast majority were constructed and are used by petroleum companies.

Id.

92. *See* Louisiana Dep't of Wildlife & Fisheries Application to U.S. Dep't of Commerce, *supra* note 87.

93. *See* D. Davis, *supra* note 88, at 121.

94. *Id.* at 93.

of the zone.

Prior to the 1940's, then, the canal complex consisted in the main of a few larger canals that traversed isolated areas for the benefit of navigation, logging, and agriculture, and a smaller web of trainasses. Since that time, the complex has virtually exploded.

Although oil was first discovered in Louisiana in 1902, it was nearly thirty-five years before full exploration of coastal oil fields began in earnest.[95] The delay was not caused so much by difficulty in gaining access to the area as it was by the absence of effective aquatic-based drilling equipment. This difficulty was solved in the mid-1930's when the first submersible drilling barge was built for inland waters, setting the stage for the growth of the modern oil and gas industry in the Louisiana wetlands.[96] By 1938, barge-mounted draglines were being used to excavate access canals for drilling barges.[97] The pattern for drilling in the marsh was set: barge-mounted draglines to excavate access canals for submersible drilling barges, which were then followed by waterborne pipe-laying equipment.

Encouraged by these developments, oil and gas exploration flourished in the coastal zone and was rewarded in 1937 and 1938 when twenty-nine new fields were discovered.[98] This record nearly doubled the number of fields developed in the coastal zone between 1902 and 1936. Oil fever struck quickly, and by 1950 no fewer than 121 oil and gas fields had been located beneath the Louisiana coastal marsh. In 1947 exploration for and

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95. *Id.* at 122.

96. Gagliano 1973, *supra* note 77, at 69. *See also* D. Davis, *supra* note 88, at 125-27:

> Successful operation of the submersible drilling barge and excavation of canals with barge mounted draglines, bucket and suction dredges, opened the coastal zone to petroleum development. This equipment was so successful that out of 623 (as of May 1972) oil and gas fields . . . , 328 or over 50% are actually in the swamps and marshes. Their location has made the petroleum industry the greatest wetland canal builder. . . . Louisiana's coastal plan is dominated by a massive system of man-made canals. The addition of new channels is a continuous process, but no effort is made to fill in the old ones. . . . When a canal is cut, it often becomes a permanent feature.

97. McGhee & Hoot, *Mighty Dredges, Little Known Work Horses of Coastal Drilling, Producing, Pipelining, Now 25 Years Old*, 61 OIL & GAS J. 150, 150-52 (1963). *But see* D. Davis, *supra* note 88, at 124 (claiming that the first floating dragline was utilized in 1926).

98. *See* D. Davis, *supra* note 88, at 122.

production of oil and gas took on an entirely new dimension when the first "offshore" well was drilled.[99] The implications for the Louisiana coast were enormous. Heavy boat traffic was required to link large land-based support facilities with the offshore drilling rigs. The volume and nature of this traffic, shuttling many workers and heavy equipment, required new navigation canals to be dredged and maintained for access between onshore facilities and the open water. Additionally, since virtually all oil and gas produced from the Louisiana outer continental shelf was to come ashore in Louisiana,[100] still more canals had to be dredged for pipelines and for oil transport barges.

Development and production of oil and gas in Louisiana reached an apparent peak in 1976.[101] Offshore production continued to increase after this period, but the decline onshore has been steady. However, these are relative terms. The equipment and the systems developed for wetland oil and gas drilling have been so successful that, as of May 1972, of 623 identified producing oil fields in Louisiana, 328—over half—were under wetlands.[102] While it was reported in 1971 that more than 25,000 wells were in operation in Louisiana's coastal zone,[103] by 1981 that number was over 28,000.[104] Actual production may have dropped, but the activities impacting the coast continue at a high level. The oil and gas industry has drilled more than 20,000 wells offshore since 1947, with 2,500 of these platforms in operation as of 1981.[105] For 1982, recent information shows a total of 4,082 rigs in operation both on and offshore, with an average of 340 operating during any one month.[106]

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99. 1948-49 La. Dep't of Conservation, Biennial Rep. at 26.

100. S. Farber & D. Johnson, The Impact of Oil and Gas Exploration, Development, and Production on the Outer Continental Shelf of Louisiana, Background and Methodology (La. Dep't of Conservation 1976).

101. Stone, Bahr, Day & Turner, *Developing Management Guidelines for Oil and Gas Activities: The Louisiana Experience*, 6 Coastal Zone Mgmt. J. 9, 12 (1979).

102. *See* D. Davis, *supra* note 88, at 125-26.

103. L. St. Amant, Impacts of Oil on the Gulf Coast, 36th North American Wildlife and Natural Resource Convention (1971).

104. Davis, *Economic and Cultural Consequences of Land Loss in Louisiana*, in Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options 152 (U.S. Fish & Wildlife Service, D. Boesch ed. 1982).

105. *Id.*

106. Fennel, *Gambit's Gauges*, Gambit Magazine, Apr. 16, 1983, at 20.

In summary, full-scale development of oil and gas deposits in the Louisiana coastal zone, beginning in the late 1930's, dramatically expanded the existing canal mileage and forever changed the face of the landscape. At surface level, as from a boat, "their great length, density, and diversity can go unnoticed. A few hundred feet above the ground, however, they stand out as dominant geomorphic features."[107] The coastal plain is now subject to a massive and still growing matrix of oil and gas canals, pipelines, spoil banks, and associated construction.[108] Virtually no section of the coastline, however small, has been spared a channel, a levee, or a pipeline leading to a collection point.[109] As the most casual viewer from the air would perceive, and as all published research on the question in the past ten years has concluded,[110] they are the major engineering features of the zone. When one refers to canals in the coastal wetlands of

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107. Turner, Costanza & Scaife, *Canals and Wetland Erosion Rates in Coastal Louisiana* in PROCEEDINGS OF THE CONFERENCE ON COASTAL EROSION AND WETLAND MODIFICATION IN LOUISIANA: CAUSES, CONSEQUENCES, AND OPTIONS 73 (U.S. Fish & Wildlife Service, D. Boesch ed. 1982).

108. D. Davis, *supra* note 88, at 141.

109. Turner, McKee, W. Sikora, J. Sikora, Mendelssohn, Swenson, Neill, Leibowitz & Pedrazini, *The Impact and Mitigation of Man-Made Canals in Coastal Louisiana*, WATER, SCIENCE & TECHNOLOGY (1983) (forthcoming) [hereinafter cited as Turner et al. 1983]:

> These canals were largely absent at the turn of the century. Almost all were constructed to help in the recovery of mineral deposits located thousands of meters below ground. Canals abound in every parish, in every wetland plant community and soil type, and have increased gradually, not suddenly, in density. In effect, a giant experiment is being conducted and we have only to recognize it as such to evaluate the results.

See Turner, Costanza & Scaife, *supra* note 107, at 73-74.

110. *See, e.g.*, J. VAN BEEK & K. MEYER-ARENDT, *supra* note 17; Adams, *supra* note 20; Craig, Turner & Day, *Wetland Losses and Their Consequences in Coastal Louisiana*, 34 Z. GEOMORPH. N.F. 225 (1980); Day & Craig, *Comparison of Effectiveness of Management Options for Wetlands Loss in the Coastal Zone of Louisiana*, in PROCEEDINGS OF THE CONFERENCE ON COASTAL EROSION AND WETLAND MODIFICATION IN LOUISIANA: CAUSES, CONSEQUENCES, AND OPTIONS 236 (U.S. Fish & Wildlife Service, D. Boesch ed. 1982); Johnson & Gosselink, *Wetland Loss Directly Associated with Canal Dredging in the Louisiana Coastal Zone*, in PROCEEDINGS OF THE CONFERENCE ON COASTAL EROSION AND WETLAND MODIFICATION IN LOUISIANA: CAUSES, CONSEQUENCES, AND OPTIONS 60 (U.S. Fish & Wildlife Service, D. Boesch ed. 1982); Stone, Bahr & Day, *Effects of Canals on Freshwater Marshes in Coastal Louisiana and Implications for Management*, in FRESHWATER WETLANDS: ECOLOGICAL PROCESSES AND MANAGEMENT POTENTIAL 314 (R. Good, D. Whigham & R. Simpson eds. 1978); Turner, Costanza & Scaife, *supra* note 107; Turner et al. 1983, *supra* note 109; D. Davis, *supra* note 88; W. Scaife, R. Turner & R. Costanza, Recent Land Loss and Canal Impacts in Coastal Louisiana (1952) (unpublished manuscript); sources cited *supra* note 77.

Louisiana, one is speaking of canals that have been constructed by or to serve the oil and gas industry.

The particular methods used to construct these canals and the impacts, direct and indirect, of these methods on the natural processes of the coastal wetlands are next discussed.

2. Canal Construction in the Coastal Zone

> Oil companies, in developing petroleum fields, cut a series of primary channels which serve as principal access routes. From these main channels other canals are added, all connecting to the main waterway. Although a field may have developed over a period of up to 40 years, all new canals and appendages will interconnect, resulting in a web of channels . . . . As the canal pattern increases in density, channels begin to coalesce producing small lakes and bays.[111]

The petroleum industry's "spectacular network of artificial waterways"[112] is the aggregate of at least three distinct types of canals that can be identified by the functions they serve: well site access canals, pipeline canals, and those navigation canals used by logistic support vessels, and petroleum transport barges.[113] The network is by no means the product of planning. It is the residuum of tens of thousands of individual decisions on where to assemble and where to drill.

Oil and gas field development generally begins with the taking of seismic readings of subsurface strata in an attempt to locate oil and gas reserves. If preliminary analysis indicates the potential for petroleum deposits, an exploratory well, and a dredged canal leading to it, is undertaken to determine their presence. If the exploratory well proves affirmative then any number of production wells are plotted and drilled to maximize recovery.[114] To provide rig access, companies first cut a series of primary channels off the nearest existing navigable channel. These canals are, at their inception, at least sixty-five to seventy feet wide, eight feet deep, and can range up to a mile in length. They are the principal means of access for exploration. Once oil

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111. D. Davis, *supra* note 88, at 142-44.
112. *Id.* at 141.
113. *Id.*
114. *See* Gagliano 1973, *supra* note 77, at 72-75.

is found, many shorter rig-access canals are dredged from the primaries, allowing the drilling rigs to be floated into position. The configuration then looks like a Christmas tree, with a central trunk and a variety of outward-reaching branches.[115]

The oil industry uses three main types of equipment for dredging access canals. Hydraulic dredges cut into the bottom with a rotating cutter head attached to the end of a long suction pipe. Dislodged earth, roots, and peat are sucked to the surface where they are pumped to a spoil area, typically a continuous mound along the side. Bucket dredges, consisting of a dragline permanently attached to a barge hull are also used. Like hydraulic dredges, they leave a continuous spoil embankment along one or both sides of the created ditch. Spud barges are similar to bucket dredges except that the dragline is not permanently attached to the barge. Thus, the dragline can be used on crawler tracks to clear swamp locations and to dig pipeline canals.

Assuming a productive field, a tertiary network of canals and ditches evolves as pipelines are laid and oil barges are used to transport the petroleum to storage tanks or refineries. Pipelines account for about seventy-five percent of this transport.[116] Pipeline routes are excavated for miles longer than the average access canal, intersecting widely-varied types of terrain and vegetation in as linear a fashion as can be achieved.

Large diameter pipe is laid by dredging a canal from forty to fifty feet wide and from six to seven feet deep through which a barge floats, laying pipeline as it goes.[117] Typically, a trench will be dredged in the canal bottom so that the top of the completed pipeline has a clearance of ten to twelve feet. The spoil material, which may be fifty to eighty percent water in content, settles and spreads to an area possibly as wide as eighty-five feet and as deep as three feet. Enough material to refill the canal may not be available afterwards because of this spreading and the oxidation of the exposed organic material which inevitably follows. The pipeline spoil banks are also characteristically un-

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115. D. Davis, *supra* note 88, at 142-44.

116. *See id.* at 145.

117. This discussion of laying floatation pipeline is based on PROPOSALS OF THE LOUISIANA ADVISORY COMMITTEE ON COASTAL AND MARINE RESOURCES (LACCMR), LOUISIANA WETLAND PROSPECTUS: CONCLUSIONS, RECOMMENDATIONS AND PROPOSALS 47-50 (1973).

broken, unless regulations require otherwise.[118]

For smaller pipelines traversing the marsh, the push pipeline technique is possible.[119] Using a special dragline or a marsh buggy-based dragline,[120] a ditch four to six feet deep and eight to ten feet wide is excavated. The pipe sections are joined together at the point of origin of the ditch, the line given temporary buoyancy by attached floats, and are pushed down the ditch. The floats are then cut loose, the pipe sinks, and about four feet of clearance exists between the pipe and the surface.

Push-type pipeline installation causes a direct conversion of marsh to water, of about one acre per mile of pipeline. The barge method causes an estimated six acre loss per mile. By comparison, the several thousand rig access canals in coastal Louisiana, which may equal the number of pipeline canals in the area,[121] result in an eight acre loss per mile of canal dredged. When to those losses are added those of the associated spoil banks, measured at five to six times wider than the canals themselves,[122] and to these the indirect effects on the adjacent marshes, a first inkling appears of the full resulting damage.[123]

It is through these methods that, in the pursuit of oil and gas, the current network of canals dredged for access and pipeline transportation has evolved in the Louisiana marshes. As a field develops, sometimes over a forty-year span, more and more interconnecting canals are dredged as additional drilling sites are discovered or become necessary. Since there is at least one canal per well, some oil fields may have thirty miles of canal in a six mile square area.[124]

"There is rarely any logical or orderly relationship between

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118. *Id.* at 2, 4.

119. This discussion of laying push-type pipeline is based on J. McGINNIS, R. EWING, C. WILLINGHAM, S. ROGERS, D. DOUGLASS & D. MORRISON, FINAL REPORT ON ENVIRONMENTAL ASPECTS OF GAS PIPELINE OPERATION IN THE LOUISIANA COASTAL MARSHES TO OFFSHORE PIPELINE COMMITTEE 2.2-2.3 (1972) [hereinafter cited as McGinnis].

120. "Marsh Buggies," vehicles with wide, oversized wheels, are more often used to carry light equipment across the marsh and for survey work. While not so damaging as the dredged canals, the buggies do compress the underlying peat. These trails may not be self-repairing and may turn into mini-canals stimulating local erosion. *Id.* at 2.3.

121. *Id.* at 3.4.

122. Turner, Costanza & Scaife, *supra* note 107, at 74.

123. *E.g.*, Gagliano 1973, *supra* note 77, at 73.

124. D. Davis, *supra* note 88, at 143.

this maze of artificial waterways and natural surface features such as drainage pattern, [and] shorelines . . . ."[125] Ownership of surface rights further complicates the maze. After drill sites are selected, oil company landmen secure surface rights-of-way and permits for access canals. The route the canals take will be determined more by property boundaries than by considerations of environmental or even economic efficiency. Consequently, canals cut across natural flow lines and surface features at random angles. Subsequent collection pipelines usually take a straight line route between the producing field and the tank battery or master pipeline connection, equally unrelated to existing hydrological features.[126] There is no role in the process for corridors or multiple-use canals.

3. Impacts and Land Loss

a. Direct effects and canal surface area

> After a field has been fully developed, the net result is an ugly scar on the landscape. The integrity of the natural environment is drastically altered. Land has been lost directly through canal dredging, and natural drainage and tidal circulation are altered. Erosion rates are increased because of the resulting increased length or land-water edge, and there is an increase in the volume of water exchange. Bank erosion caused by wakes of boats engaged in production activities is a particular problem.[127]

The most easily appreciated, if in ways the most misleading, relationship between canals and land loss is the direct conversion of marshland to canal surface area. Canal density for the whole deltaic plain has increased steadily in this century. Indeed the canal surface area has increased geometrically since records have been kept, more than doubling in the last twenty years.[128]

In assessing information on direct losses to open canal water, a hidden factor must be recognized. Available data are taken largely from government permit records[129] and mask the

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125. Gagliano 1973, *supra* note 77, at 72.

126. *Id.* at 73.

127. *Id.* at 73-74.

128. *See* Turner, Costanza & Scaife, *supra* note 107, at 74.

129. Records of the Louisiana Department of Natural Resources, for example, ir
cated the direct conversion of 2.75 square miles of marsh to canal surface area ir

scope of construction in the field. Assuming that no canal dredging in the coastal zone takes place without a permit—an assumption that would attract few wagers—a recent study shows that, in a statistical sampling, newly dredged canals were substantially larger than the dimensions specified on permit applications.[130]

Even with these additional amounts factored in, the size of newly-dredged canals does not account for the entire, or perhaps even the majority, of the increase in canal surface area recorded between any two periods of time. Numerous studies have shown that each of these channels and ditches widens over time with little further assistance from man.[131] The widening phenomenon is occurring in both the more stable chenier plain and in the softer Mississippi delta, and in all marsh types as well. The annual increase in canal width has been estimated to range from about two to fourteen percent per year, a *doubling* in from five

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Id. at 79-81. Of the first 2,000 dredging permits applied for in 1981, fewer than a half dozen were denied by the Department of Natural Resources, and each of these was subsequently approved on appeal. *Id.* at 82. For a discussion of the state regulatory program, see *infra* pp. 148-65, Section V(D).

130. The newly dredged canals examined in this study were an average of 13 m wider than the widths specified on permit applications. In no case were they narrowed. This was expected, *since the width indicated in the permit request is the minimum width at the bottom of the canal.* Canal side slopes are typically about 3:1 . . . . Berms are encouraged because, although they expand the total impact width, they also prevent spoil from backwashing . . . . Our regression analyses showed that berm and spoil bank together generally added 68 m to the width of the wetland corridor destroyed in canal construction. When the extra unauthorized canal width was included, the total corridor width was 81.7 m wider than the permitted canal. *For a well-access canal permitted at about 21 m (65 feet) the total impacted width was typically about 103 m or five times the permitted canal width.*

Johnson & Gosselink, *Wetland Loss Directly Associated with Canal Dredging in the Louisiana Coastal Zone*, in PROCEEDINGS OF THE CONFERENCE ON COASTAL EROSION AND WETLAND MODIFICATION IN LOUISIANA: CAUSES, CONSEQUENCES, AND OPTIONS 60, 67-70 (U.S. Fish & Wildlife Service, D. Boesch ed. 1982) (emphasis added).

131. *Id.* at 61-71. The following graph indicates the relationship between permitted and actual canal size:

to sixty years.[132]

Several factors have been cited for contributing to this widening, and for its varying rates. One obvious and well-accepted cause is wave action from passing vessels. One study[133]

131. *Id.* at 61-71. The following graph indicates the relationship between permitted and actual canal size:

Comparisons of permitted versus actual canal dimensions, using paired t-tests.

Dimension	Actual mean measurement (m)	Permitted mean measurement (m)	t Statistic	P > t
Depth	2.9	2.5	4.43	0.1511
Berm width	4.6	7.6	-4.43	0.0003
Canal width	34.4	23.5	6.30	0.0001
Total canal length	574.9	573.9	0.05	0.9643
Slip length	112.2	106.1	1.22	0.3471

132. *See* Craig, Turner & Day, *supra* note 110, at 231.

133. Craig, Turner & Day, *supra* note 5, at 138.

The following graph illustrates the annual increase of canal width and the time necessary to double the canal area:

Example (years of survey)	Source	Annual increase of canal width (%/year)	Doubling time (years)
A. Bayou St. Denis (1926-1976)	Davis (1973)	8.2	8.4
B. Humble Canal (1953-1958)	Nichols (1958)	1. 8.3	8.3
		2. 7.5	9.3
		3. 6.9	10.1
		4. 6.5	10.7
C. Superior Canal	Nichols (1958)	1. 14.8	4.7
		2. 12.4	5.6
		3. 13.9	5.0
		4. 12.4	5.6
D. Golden Meadow (1940-1953) (1953-1969)	This study	1. 2.0	34.6
		2. 3.7	18.5
		3. 4.0	17.2
		4. 2.0	34.6
		5. 3.0	23.1
		6. 4.6	15.0
		7. 3.0	23.1
		8. 2.0	34.6
E. Falgout Canal (1905-1970)	Davis (1973)	9. 4.6	15.0

has compared the widening of three different canal systems and concluded that boat traffic greatly influences erosion rates. For example, dead-end canals extending from major nearby navigation canals widened 4.53 feet per year faster than similar canals off oil field navigation canals and 5.05 feet per year faster than dead-end canals some distance from boat traffic.[134]

A second factor is the change worked in hydrology. Water will pursue a path of least resistance, and straight canals are less resisting than meandering natural streams. There is an apparent relationship between the size of the canal and the yearly increase in width experienced. The larger the canal, the faster it widens. Though this result too may reflect boat traffic, it also includes the results of increased flows; more water moves through.[135] The eroding influence of the water on its banks is the same, hydrologically, whether the head is from the north as fresh water or from the south as tidal scour.[136]

Research has also examined the difference between an older canal, which has been experiencing greatly accelerated widening rates, and a few younger canals with still low and linear widening rates.[137] One study explained the difference by showing that initial widening is slowed by the consolidated spoil banks, which, once eroded through, present no further obstacle. The study presumes that most of Louisiana's oil field canals are still recent and are still eroding through their spoil banks, so their widening rates are low; when these canals reach an age of thirty to seventy

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Id.

> The study reaches the following conclusions on canal widening:
>
> It is evident from the few examples available that canal widening is occurring throughout the entire coastal zone, influencing the geologically more stable chenier plan [sic] as well as the deltaic plain. . . . The annual increase in canal width ranges from about 2 to 14% per year for a doubling time of 5-60 years. . . . We shall attempt to put this in perspective. . . . Canals, which represent 2-4% of this total (now), are widening at a rate an order of magnitude greater than the present land loss rate and may eventually be the dominant factor causing land loss in Louisiana—simply by widening at the current rate. For example, assume an enlargement rate of 5% per year. This is equivalent to a doubling rate of 14 years. . . . In 14 years the present 2.6% canal density in Barataria Bay . . . may become 5.2% of the total area, or [approximately] 10.0% by the year 2001, 20% by 2020.

Id.

134. *See* Johnson & Gosselink, *supra* note 130, at 70.
135. *Id.* at 60, 67.
136. *See* Craig, Turner & Day, *supra* note 5.
137. Johnson & Gosselink, *supra* note 130, at 60.

years, their associated land loss rates will accelerate rapidly.[138]

On reflection, this conclusion bodes ill for the coast. It is the picture of a time-delayed reaction. Canal surface area, which now represents two to four percent of the total land mass, is already widening at a rate and order of magnitude greater than the present overall land loss rate. Whatever is done about future canals, the expansions of *existing* canal surfaces may soon be the dominant cause of land loss in Louisiana.

b. Indirect effects

> A second conclusion is that the *indirect* influence of canals is far more important than their *direct* impacts . . . . The influence of canals on coastal erosion rates is therefore a *continuing* legacy that extends decades beyond the time of their construction.[139]

Research now shows that the serious consequences of the direct impacts of canal dredging in the coastal zone are matched or surpassed by the indirect impacts.[140] As discussed earlier, the coastal wetlands are a living system entirely dependent for soils, nutrients, and fresh water on the flow of water itself. Canals play havoc with water flow in several major ways: accelerated freshwater outflow, reduced water quality, impoundments, and increased saltwater intrusion. Each of these alterations in the natural functioning of the marsh ecosystem contributes to the

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138. *Id.* at 70.

139. W. Scaife, R. Turner & R. Costanza, *supra* note 110, at 11 (emphasis in original).

140. Johnson & Gosselink, *supra* note 130, at 70.

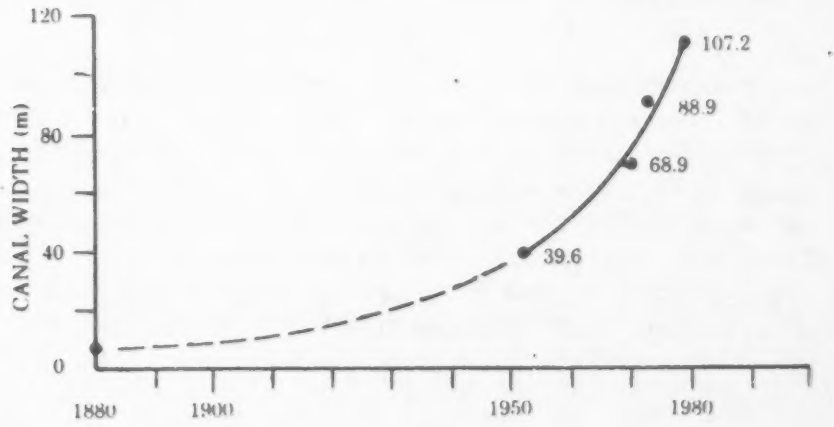
> Thus, we hypothesize that once spoil banks are eroded away, one can then expect a dramatic increase in canal widening rates. The Rockefeller Refuge canals are still eroding through the spoil banks, as are most of Louisiana's oil field canals. Therefore, their widening rates are relatively low and linear . . . . We predict that when these canals become 30 to 70 years old their associated land loss rates will begin to accelerate rapidly.

Id. The same study provides the following on canal widening, over time:

deterioration of the system, and thus to land loss.[141]

The Louisiana coastal zone is an extensive web of marsh and small, meandering rivulets and streams that travel, slowly and circuitously, from north to south toward estuarine bays and the Gulf of Mexico. The continuous filtering of fresh water through this system effectively counteracts the opposing tidal pressures of open waters, thereby regulating the degree of saltwater intrusion.[142] The sinuosity and branching pattern of this natural delta system is, in effect, the control valve for water levels, water chemistry and temperature, and indirectly, for all flora and fauna.[143] Dredging destroys the valve.

On one level, canals expedite the outflow. They remove fresh water from upper portions of basins much faster than overland flows or meandering bayous would permit. This is particularly true of canals that run perpendicular to the coastline



Id. at 67.

141. "From 1955 to 1978 canal surface area accounts for less than 10% of the actual land loss; yet canal density may account for 48% to 97% of the statistical variation in regional land loss rates." W. Scaife, R. Turner & R. Costanza, *supra* note 110, at 11.

142. "[W]etlands are, by definition, dependent on the hydrological regime for the maintenance of ecosystem integrity. Sediments, nutrients, and gases move from wetland to water and back again in very complex ways, which we are only now beginning to describe in detail." Turner, *Wetland Losses and Coastal Fisheries. An Enigmatic and Economically Significant Dependancy*, in PROCEEDINGS ON COASTAL EROSION AND WETLAND MODIFICATION IN LOUISIANA. CAUSES, CONSEQUENCES, AND OPTIONS 112, 114 (U.S. Fish & Wildlife Service, D. Boesch ed. 1982).

143. *See* McGinnis, *supra* note 119, at 2.7.

and flush freshwater bayward during periods of low water. As a result, freshwater storage and the "lag time" of freshwater runoff is altered within the marshes.[144] The situation becomes, relatively speaking, flood or famine. Research on simulated canal alignments has found that north-south canals decrease water flow over the whole marsh by eight to nine percent, reducing water flow to ninety-four percent of normal in some localized areas.[145] With the demise of freshwater comes a decrease in all of the building forces, and an intrusion of saltwater from the Gulf. Marsh gives way to open water and land subsides.

Another adverse consequence of freshwater channeling is its effect on water quality. Marshes absorb nutrients that would pollute open water bodies.[146] Studies indicate that many canals allow water laden with nutrients to bypass wetlands and flow directly into large water bodies,[147] causing the development of algal blooms and declines in commercial and sport fish species.

Impoundments present yet another problem. Canals parallel to the shoreline place spoil barriers in the way of natural drainage patterns. Spoil banks, the by-product of virtually every dredged canal,[148] act as man-made levees. Standing water develops on one side; the result is slowed drainage or complete containment of natural water flow, inundating the upstream area and depriving the area below.[149] Subsidence can also result from the loss of marsh on the spoil bank's periphery as depressions form on the flanks.[150] The spoil banks may also cause subsidence by constricting subsurface water flows. A computer study, utilizing simulation models, found that canal banks aligned with the shore altered water regimes by an average of thirty-five percent from normal conditions.[151]

As early as 1957 the relationship between increased canal density and higher rates of saltwater intrusion was noted. The

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144. *See* Gagliano 1973, *supra* note 77, at 3.

145. J. VAN BEEK & K. MEYER-ARENDT, *supra* note 17.

146. *See* Stone, Bahr & Day, *supra* note 110, at 314-17.

147. *See* Turner, *Aspects of Land-Treated Waste Applications in Louisiana Wetlands*, in FRESHWATER WETLANDS AND SEWAGE EFFLUENT DISPOSAL 145-67 (Tilton, Kadle & Richardson eds. 1976).

148. *See* Stone, Bahr & Day, *supra* note 110.

149. *See* McGinnis, *supra* note 119, at 3.9-3.10.

150. *See* Turner et al. 1983, *supra* note 109.

151. Adams, *supra* note 20, at 61.

effect of salt water intrusion on brackish and fresh marshes is gradual, but devastating.[152] Plants die and the organic substrate becomes loose without the vegetative root system to hold it together. As increased tidal action moves through the area, small amounts of this loosened organic matter are massaged apart, and mineral soils are separated, taken up by the current, and flushed out to sea. Before new species of plants more resistent to salinity take hold—if they do at all—marsh elevations may drop ten to twenty centimeters over broad areas. More frequently, brackish ponds and lakes are formed; more land is lost.[153]

The Mississippi River Gulf Outlet (MRGO), although a multipurpose navigation canal, affords a single, well-documented example of how canal systems work generally to change both the land-to-water ratio and the species composition of a coastal area.[154] As originally constructed over twenty years ago, MRGO converted 6,653 acres of marsh to open water and buried another 17,344 acres under spoil.[155] Since then, the banks of the canal have been continuously eroding, at some points up to three times the original dimensions. Further, high saltwater intrusion up the MRGO has changed the biotic character of approximately 45,000 adjacent acres from freshwater marsh to open water and brackish marsh.[156] Freshwater species have been eliminated from the area.[157] The zone for production of salt-sen-

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152. 1956-1957 LOUISIANA WILDLIFE & FISHERIES COMM'N, BIENNIAL REP., *cited in* V. VAN SICKLE, B. BARRETT, L. GULICK & T. FORD, BARATARIA BASIN: SALINITY CHANGES AND OYSTER DISTRIBUTION 13 (1976) ("the net result has been drastic increases in salinity in some areas and a rapid deterioration of productive marsh and bay conditions").

153. Chabreck, *The Effect of Coastal Alteration on Marsh Plants*, in PROCEEDINGS OF THE CONFERENCE ON COASTAL EROSION AND WETLAND MODIFICATION IN LOUISIANA: CAUSES, CONSEQUENCES, AND OPTIONS 96 (U.S. Fish & Wildlife Service, D. Boesch ed. 1982).

154. *See id.*

155. Construction of the MRGO resulted in the destruction of 9,714 ha[hectare] of marsh comprising 2,695 ha for the channel and 7,019 ha by spoil deposition . . . . The ratio of canal area to spoil area is 1:2.6. [One authority] noted that for a 15 m-wide pipeline flotation canal the direct conversion of marsh area to canal area was 153 ha per km. The conversion of marsh to spoil levee was 5 ha per km (canal: spoil ratio of 1:2 to 1:3). They noted that the total marsh area with altered character would be about 10 ha per km. [Another authority] suggests that the area of land whose productivity is altered is 5 to 6 times that of the canal itself.

Craig, Turner & Day, *supra* note 110, at 233 (citations omitted).

156. *See* Stone, Bahr & Day, *supra* note 110, at 313.

157. *See id.*

sitive commercial species, such as the oyster, is narrowed and pushed north, perilously close to the urban and industrial expansion moving down from the north.[158]

These same processes, most visible in a single, large canal, are at work daily from the thousands of individual pipeline, access, and navigation channels through the coastal zone. It may be useful to observe them at work in one other example, not in terms of acreage lost but rather as an aerial view of a marsh system, before and after the entry of an oil facility and related canals. The diagram that appears on the following page is taken from aerial photographs of a coastal area at the base of Lafourche Parish.[159] The entry of the area by oil facilities, and their effects, are shown. The second diagram, which appears on page 43, depicts the introduction of canals in a study area in Terrebonne Parish.

The death of plants and root systems, the glue that binds the coast together and in many places, through mats of peat, constitutes the very coast itself, is not easily observed. Comparing canal impacts, direct and indirect, canal surface area accounted for thirty-nine percent of the total coastal land loss between the mid-1930's and 1955;[160] impoundment, intrusion, and freshwater flushing were only beginning to work. From 1955 through 1978, on the other hand, canal surface area accounted for less than ten percent of the loss.[161] The time-delayed effects

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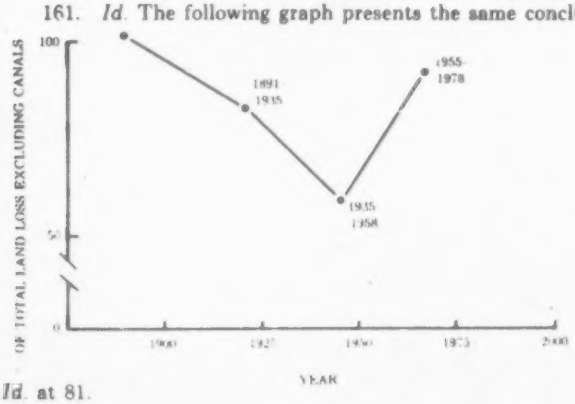
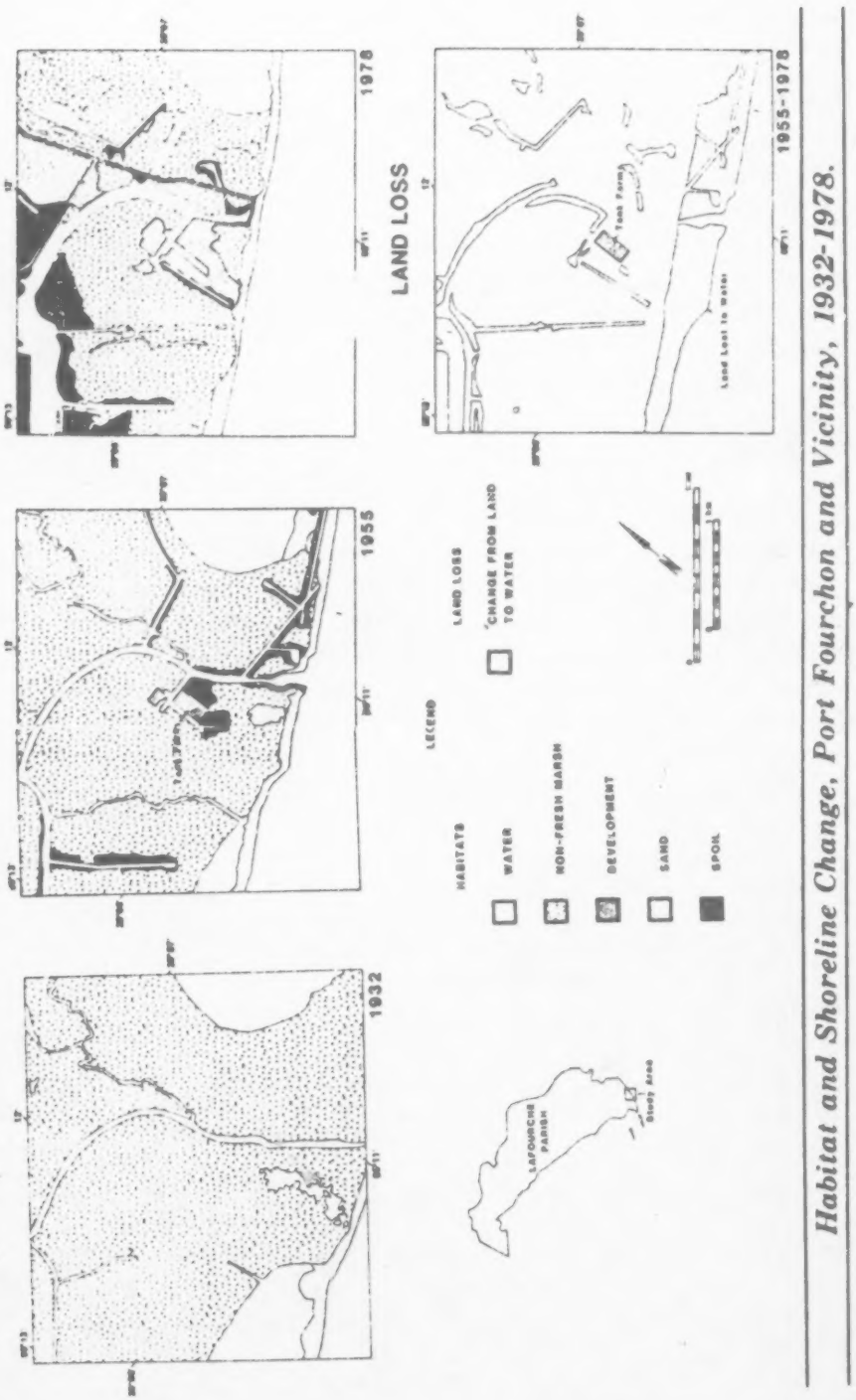
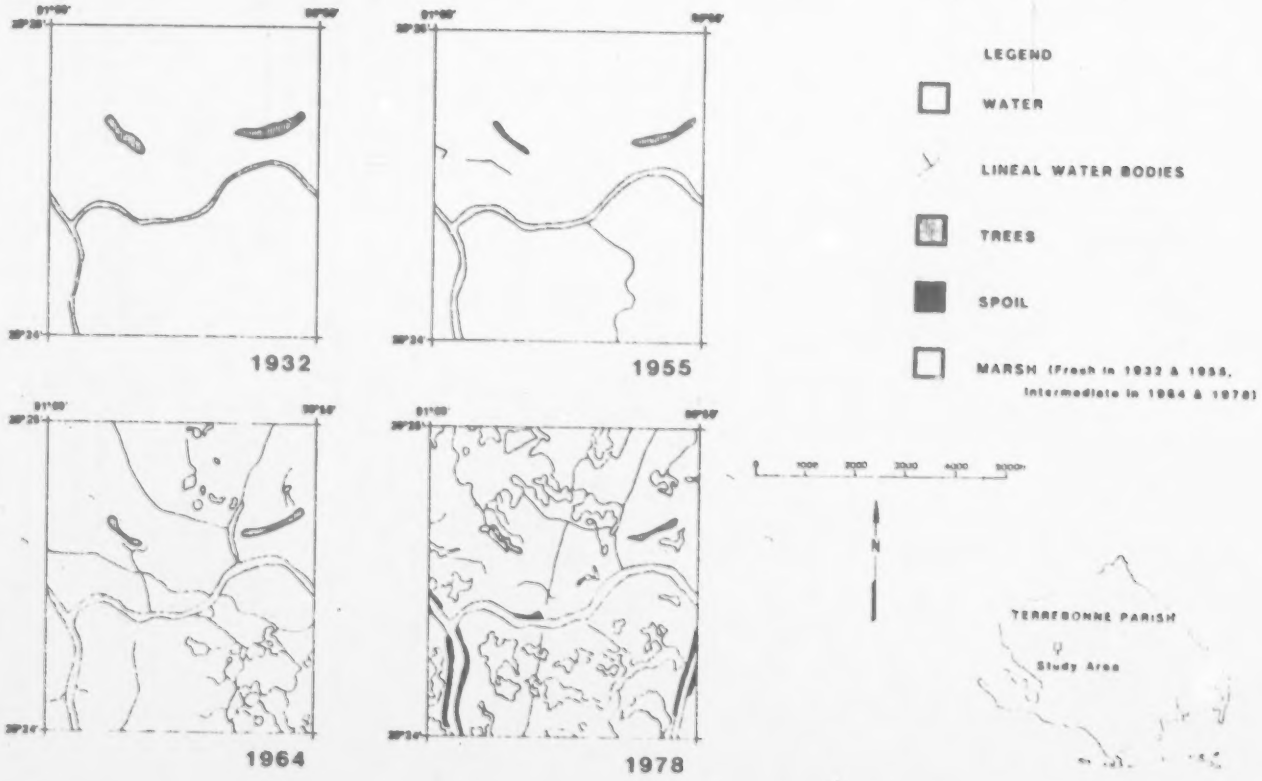
158. *Id.* at 314-17.
159. *See* J. VAN BEEK & K. MEYER-ARENDT, *supra* note 17, at 32.
160. *See* Turner, Costanza & Scaife, *supra* note 107, at 79.
161. *Id.* The following graph presents the same conclusion.



Id. at 81.



Habitat and Shoreline Change, Port Fourchon and Vicinity, 1932-1978.



Impact of Canals Upon Wetland Deterioration.

have taken hold. The canal systems' contribution to the accelerating rates of land loss is now plain.[162]

c. Navigation canals and the oil and gas role

> The essential justification addressed for this project is navigation benefit to vessels and structures involved in the offshore oil and gas industry.[163]

To this point in the discussion, a distinction has been made between navigation works in the coastal zone, primarily those along the lower Mississippi River and its outlets, and other canals and pipeline ditches serving the oil and gas industry. The distinction is valid in one respect; insofar as access and pipeline

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162. The oil and gas industry article takes the rather novel position that oil and gas canals "may actually improve estuarine conditions," Edwards, Zehner & Moore, *Constitutional and Policy Implications of Louisiana's Proposed Environmental Energy Tax: Political Expediency or Effective Regulation?*, 58 TUL. L. REV. 215, 260 (1983), and that "spoil banks, canals, impoundment and semi-impoundments have . . . many potentially beneficial uses," e.g., "creating access to previously inaccessible marshes." *Id.* at 260, 261. Access is of course hardly an estuarine improvement. As we have seen to the contrary, it is a prime cause of erosion. The tragedy of the coast is not one of diminishing access, but of diminishing marshland. The alleged "beneficial uses" of spoil banks are said to include "sites for recreation, timber production, aquaculture, waste assimilation and energy production from growing plants." *Id.* at 261. These "benefits" can be examined *seriatim*. Whatever recreation may take place on spoil banks in the best of hypotheses, it is hardly of benefit in counteracting the contributions of these same spoil banks to erosion and subsidence. Timber production and aquaculture have to date proven to be rather uniform failures in the coastal zone. *See, e.g., infra* note 397. Waste assimilation and energy production from growing plants, other alleged benefits of spoil banks in the marshes, are the very functions of the living marsh which are *eliminated* by canals, spoil banks, and the conversion of the marshes to open water. *See, e.g., infra* notes 307-19 and accompanying text. The only authority cited for these somewhat extraordinary propositions is an unpublished dissertation on the vegetative profiles of spoil banks along petroleum canals. Edwards, Zehner & Moore, *supra*, at 261-62 (citing J. Monte, The Impact of Petroleum Dredging on Louisiana's Coastal Landscape: A Plant Biographical Analysis and Resource Assessment of Spoil Bank Habitats in the Bayou Lafourche Delta (Dec. 1978) (Ph.D. dissertation, Louisiana State University)). The dissertation itself, however, notes that a 10-13% landloss due to impoundments results, J. Monte, *supra*, at 162, 171, and that any "benefits" attributed to spoil banks disappear. Having done their damage, they subside into the very open waters they have created. J. Monte, *supra*, at 164. No published research on the coastal zone has ever concluded that these "beneficial effects," however dubious, begin to offset the overwhelming evidence of adverse effects wrought by canals and pipelines on the coastal systems. Almost a dozen separate studies have reached exactly the opposite conclusion. *See* studies cited *supra* notes 77, 110.

163. South La. Envt'l Council v. Rush, No. 74-678, slip op. at 9 (E.D. La. Aug. 30, 1978), *aff'd sub nom.* South La. Envt'l Council, Inc. v. Sand, 629 F.2d 1005 (5th Cir. 1980).

canals have been dug for oil and gas production, the industry's responsibility for their consequences is clear. The distinction is not so clear in another respect, however, because of the sizable role of oil and gas in the construction and use of the federally-constructed navigation system that also transects the coastal zone with fewer, but larger, canals. An attempt needs to be made, then, to assess the size of these waterways and their relationship to the oil and gas industry.

The conversion of the lower Mississippi River to a navigation outlet has given rise to major port facilities at Baton Rouge and New Orleans.[164] The lower river also serves, as shall be seen, a substantial traffic in vessels engaged in some phase of the oil and gas industry, and thirteen separate oil refineries with a storage capacity of twenty-three million barrels of petroleum commodities.[165] Beyond this one celebrated navigation corridor is another extensive complex throughout the region.

Appreciation of this complex may begin with the identification of eighteen separate deepwater ports and port commissions, in addition to those at Baton Rouge and New Orleans, located in Lake Charles, La Place, Point à la Hache, New Iberia, Morgan City, Abbeville, Delacambre, Galliano, Chalmette, Albany, Gretna, Houma, Grand Chenier, Cameron, and Mermentau.[166] To these can be added smaller bayou ports on the Barataria, Bonfouca, Petit Anse/Tigre/Carlin, Lacarpe/Dulac and Grand Caillou, Dupre, Freshwater, Johnson Bayou, La Loutre/St. Malo, Yscloskey, Lacombe, Lafourche, Little Caillou, Segnette, and Terrebonne waterways, each of them located within the coastal zone.[167] Additional port facilities serve the Atchafalaya, Mermentau, Pearl and Vermilion Rivers, the Franklin Canal, Houma

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164. For descriptions of traffic through these ports, see DEEP DRAFT ACCESS, *supra* note 9, at 12-38; OFFICE OF COASTAL ZONE MANAGEMENT, NATIONAL OCEANIC & ATMOSPHERE ADMIN., DEP'T OF COMMERCE & LA. COASTAL RESOURCES PROGRAM, LA. DEP'T OF TRANSP. & DEV., DRAFT ENVTL. IMPACT STATEMENT & THE PROPOSED LA. COASTAL RESOURCES PROGRAM 29-30 (undated) [hereinafter cited as DRAFT ENVIRONMENTAL IMPACT STATEMENT, LOUISIANA COASTAL RESOURCES PROGRAM]; U.S. ARMY CORPS OF ENG'RS, WATERBORNE COMMERCE OF THE UNITED STATES, CALENDAR YEAR 1980, PART 2, WATERWAYS AND HARBORS, GULF COAST, MISSISSIPPI RIVER SYSTEM AND ANTILLES (1981) [hereinafter cited as WATERBORNE COMMERCE].

165. DEEP DRAFT ACCESS, *supra* note 9, at 23.

166. DRAFT ENVIRONMENTAL IMPACT STATEMENT, LOUISIANA COASTAL RESOURCES PROGRAM, *supra* note 164, at 33.

167. *Id.* at 32.

Canal, Pass Manchac, Mississippi River Gulf Outlets and Gulf Intercoastal Waterway.[168]

No mere listing of these projects, in large part constructed by the U.S. Army Corps of Engineers, conveys the sense of their dimensions. In the Mississippi delta alone, beyond the mainstream river navigation complex, lie more than a dozen separate commercial waterways, averaging at least eight feet deep and eighty feet wide, some as large as the thirty-six-foot by five hundred-foot Mississippi River Gulf Outlet, and totaling over three hundred miles.[169] Another dozen navigation systems are located

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168. *Id.*

169. These projects include:

Mississippi River Delta area, from Lake Borgne to the East Atchafalaya Basin Protection Levee

Bayou LaFourche Jump Waterway—
authorized 6' depth, 60' width, from Napoleonville to Lockport, a similar channel from LaRose to the Gulf with a jettied entrance and the closure of a natural bayou, completed in part in 1941; modified subsequently to 9' x 100' from Golden Meadow to Leesville, 12' x 125' from Leesville to the Gulf, extensions of jetties, and auxillary 12' x 125' canal connecting to the Barataria Bay Waterway.

Bayou Terre Aux Boeufs—
5' x 50' navigation channel, boundary between Plaquemines and St. Bernard Parishes.

Barataria Bay Waterway—
37 miles, originally completed to 5' depth, 50' width, increased in 1963 to 12' x 125' and a 4.3 mile extension, widened in part to 250' in 1967, increased bar entrance channel to 15' x 250' in 1978.

Bayou Dupre—
7.3 miles, 6' deep, 80' wide, including a 100' by 200' turning basin.

Bayous Loutre, St. Malo, and Yscloskey—
30 miles, various channel sizes from 5' x 30' to 6' x 40 completed in 1956.

Bayou Segnette—
a 6 mile channel, 6' x 40', constructed in 1945, enlarged in part to 8' x 50' in 1951.

Bayou Segnette Waterway—
an 8' x 80' channel completed in 1957, 12.2 miles long.

Bayou Terrebonne—
24 miles, 6' channel, originally constructed in 1916, modified and enlarged in 1959 and 1964.

Houma Navigation Canal—
15' x 150' channel from the Gulf Intracoastal Waterway (GIWW) at Houma to the 60 m. depth of the Gulf of Mexico, completed in 1962, maintained at federal cost since 1963.

Little Caillou Bayou—
20 mile channel, 5' x 40', from Robinson Canal to Little Caillou Bayou.

Mississippi River Gulf Outlet—
76 mile ship channel, 36' x 500', from New Orleans to the 38' contour in the

through the marshes to the west, from the Atchafalya delta to the Texas border, with average dimensions in excess of ten feet by one hundred feet and a total length of over two hundred miles.[170] Across the entire coast runs the Gulf Intercostal Water-

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Gulf of Mexico, locks, jetties, and turning basins, in Gulf waters the dimensions increase to 38' x 600', completed in 1968.

Waterway from the Intracoastal Waterway to Bayou Dulac—

16.3 mile channel, 5' x 40', from GIWW at Houma to Bayou Dulac, completed in 1938; modified and enlarged in 1964 to 10' x 45' dimensions.

Waterway from Empire to the Gulf of Mexico—

9' x 80' channel from Empire to the Gulf, jetties from the 6' to the 9' contour, completed in 1950.

LOWER MISSISSIPPI VALLEY DIV., U.S. ARMY CORPS OF ENG'RS, WATER RESOURCES DEVELOPMENT IN LOUISIANA 1981, at 99-108 (undated) [hereinafter cited as WATER RESOURCES DEVELOPMENT IN LOUISIANA 1981].

170. These projects include:

Atchafalaya River Basin Outlets

Atchafalaya River, Morgan City to the Gulf—

20' x 200' channel, 16 miles in length, from Morgan City to deepwater in the Gulf of Mexico, enlarged to 20' x 400' in 1974.

Atchafalaya River and Bayous Chene, Boeuf, and Black—

20' x 400' channel, approximately 50 miles from Highway 90 near Morgan City to the 60 m. contour in the Gulf of Mexico.

Vermilion River and Bayou Teche Basins

Bayou Teche and Vermilion—

8' x 80' channel to New Iberia; 6' x 60' to Arnaudville.

Bayou Teche and Vermilion River—

8' x 80' channel from Vermilion Bay to the GIWW; 9' x 100' channel from the GIWW to Lafayette, completed in 1957.

Freshwater Bayou—

12' x 125' waterway between the GIWW near Vermilion and the Gulf of Mexico, completed in 1967.

Petit Anse, Tigre, and Carlin Bayous—

a range of channels from 7' x 60' to 9' x 80' from GIWW in the area of Vermilion Bay, completed in 1962; enlargements authorized to 12' x 125' in 1976.

Mermentau River Basin

Mermentau River—

channel enlargement, cut offs, and side channels of 6' x 60' dimensions.

Calcasieu River Basins

Calcasieu River and Pass—

a channel with dimensions ranging from 40' x 400' to 35' x 250'; mooring and turning basins.

Sabine River Basin

Sabine-Neches Waterway—

85 miles of deepwater and 8.7 miles of shallow draft channels through a jettied exit to the Gulf of Mexico, dimensions from 12' x 125' to 30' x 200'.

Id. at 36-133.

way, twelve feet deep, 150 feet wide, and 302 miles long, with yet another seventy-six miles of side canals averaging eight feet by sixty feet, dredged regularly to maintain these dimensions.[171]

Once the number and size of these facilities are understood, each of them intersecting and interacting with the coastal zone in ways earlier described, it remains to identify the oil and gas role in their development and use. Together, these waterways serve a variety of boat traffic including bulk commodities, fisheries (on the smaller bayous in particular), and petroleum development. The Atchafalaya River, Bayous Chene, Boeuf, and Black project, because it was the subject of litigation on this point,[172] provides an illustration of the relative importance of the petroleum industry in their construction. Although described generally as a "navigation" project with an auxiliary channel to "shipyards" on Bayou Black, a district court discovered the purposes of the Atchalafaya River, Bayous Chene, Boeuf, and Black project to be considerably more specific: access to offshore oil. Upon examining the cost-benefit ratio, the court found: "The Corps quantified these benefits by calculating the savings in transportation time which would result from the widened and deepened channel."[173] The reviewing circuit court characterized the project's purpose similarly: "The project was designed to facilitate the movement of offshore drilling rigs and related marine equipment between construction and service facilities on Bayou Boeuf and Black and the drilling sites in the Gulf of Mexico."[174]

What appears at first blush to be a general purpose navigation facility thus turns out to be, in fact, a canal built to serve the oil and gas industry. While a comparable level of detail is not readily available for all waterways in the coastal region, the importance of oil and gas in them does appear from summary

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171. *Id.* at 133-36.

172. South La. Envt'l Council v. Rush, No. 74-698, slip op. at 9 (E.D. La. Aug. 30, 1978), *aff'd sub nom.* South La. Envt'l Council v. Sand, 629 F.2d 1005 (5th Cir. 1980).

173. *Id.* (citations omitted). At issue in the litigation was the legitimacy of the Corps' conclusion that, "in times of impending danger, 80% of the large submersible and semi-submersible drilling rigs in the project area would disengage from drilling operations in the Gulf of Mexico and be towed to the safety of inland waters in the Morgan City area." *Id.* The district court found the inclusion of this benefit "not valid," and "arbitrary and capricious." *Id.* at 34. The appellate court held these findings "supported by the evidence at trial." 629 F.2d at 1012.

174. 629 F.2d at 1009.

documents of the Corps of Engineers.[176] As noted in these documents, virtually every major navigation canal in south Louisiana serves the oil and gas industry.

Returning now to the dominant navigation project in the coastal zone, the lower Mississippi River, statistics from the Corps of Engineers show a total of 131,280,800 tons through this stretch in 1976.[176] Of these, over forty-seven million tons were crude petroleum with another nineteen million plus in petroleum products, the first and third ranking commodity categories listed.[177] From these statistics alone, and excluding traffic in tugs, barges, draglines, and other vessels serving oil and gas-related businesses, nearly half of the total service of the lower

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175. The descriptions which follow are taken from WATER RESOURCES DEVELOPMENT IN LOUISIANA 1981, *supra* note 169:

Barataria Bay Waterway: "Average annual traffic from 1974-1978 was 2,505,544 tons, consisting mainly of oil industry cargo and liquid sulphur." As noted above this project, although originally constructed prior to the oil boom in coastal Louisiana, has been expanded three times in the past twenty years to accommodate the needs of the oil and gas industry. This pattern recurs for virtually all of the earlier waterways.

Bayou Dupre: "The oil industry provides the major cargo in this waterway . . . ."

Bayou Lafourche and Lafourche Jump Waterway: "Offshore oil operators, sulphur mining and commercial fishing benefit from this project."

Bayous LaLoutre, St. Malo, and Yscloskey: "This 30-mile project has been used by oil companies as a safe, inland route for transporting crude oil equipment and personnel."

Bayou Terrebonne: "Operational supplies for drilling for crude oil comprises the major cargo on this waterway . . . ."

Houma Navigation Canal: "[T]raffic on this waterway averaged 2,329,538 tons annually with the oil industry contributing the major cargo."

Mississippi River Gulf Outlet: "Major types of cargo moving in the channel include crude petroleum, primary metal products, and grain."

Waterway from Empire to the Gulf of Mexico: "The needs of a large fishing fleet and those of adjacent offshore oil operations are served . . . ."

Freshwater Bayou: "[The bayou] gives access to petroleum, gas, salt and sulphur resources in the gulf."

Atchafalaya River, Morgan City to Gulf of Mexico: "Since then [1954], the burgeoning offshore oil industry has expanded traffic dramatically (from 500,000 to 3,712,868 tons per year)."

Calcasieu River and Pass: "[C]rude petroleum, petroleum products and chemicals account . . . for the major portion of the cargo."

176. DEEP DRAFT ACCESS, *supra* note 9, at 20 (citing U.S. ARMY CORPS OF ENG'RS, WATERBORNE COMMERCE OF THE UNITED STATES, CALENDAR YEAR 1976 (1977)).

177. *Id.*

Mississippi navigation project, its jetties and levees, is provided to the oil and gas industry.[178] Government statistics also show the oil and gas usage at almost the same percentage for the Gulf Intracoastal Waterway.[179]

Mention should be made of the requirements for maintenance of this navigation system, which must in large part be dredged continuously to secure adequate channel depths.[180] Each operation requires the deposit of more spoil. A related maintenance problem with impacts on coastal plant systems is the control of water hyacinths, a canal-choking form of vegetation imported from South America to the United States in 1884 for exhibition at the New Orleans Cotton Exposition.[181] The hyacinth is now estimated to cover more than half a million acres of water in Louisiana, despite federal and state control efforts at about one million dollars per year. The Corps of Engineers, the leading federal agency in hyacinth control, reports that "[s]ince the late 1940's, use of the plant hormone 2, 4-D gradually replaced mechanical destruction, except in unusual cases."[182] For "plant hormone," one may read "herbicide," the introduction of which at high volume on a continuing basis into the plant-based fabric of the Louisiana coast is another, largely unassessed, and adverse consequence of canals in the coastal zone.

There is then a substantial navigation complex through the Louisiana coastal zone, separate from that narrower but more extensive network built for private access and pipeline transportation by oil and gas companies. The two are intertwined. The larger navigation canals provide trunk access from which the companies can cut to new sites and corridors. They also provide access for the salt Gulf waters that reach up through them like

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178. *Id.* The proposition is perhaps obvious. The following statement is taken from a brochure entitled "Bayou Cruise, Bayou Jean Lafitte" of the New Orleans Steamboat Company: "Today, the modern industrial growth of the New Orleans area spreads outward from the City. The vast array of shipyards and businesses represent the impact of oil and gas on the economy of Louisiana and the Nation." The point is simply that they also represent the impact of oil and gas on the coastline.

179. *See* WATERBORNE COMMERCE, *supra* note 164.

180. *See, e.g.*, DEEP DRAFT ACCESS, *supra* note 9, at 81, 85-93, for the scope of the maintenance requirements for the proposed 55' deep-draft channel for the lower Mississippi River. One alternative plan's maintenance requirements would exceed those of the initial construction every three years.

181. WATER RESOURCES DEVELOPMENT IN LOUISIANA 1981, *supra* note 169, at 137.

182. *Id.*

arms of the sea to penetrate the interior canals and ditches. That the interior oil and gas system remains the larger network can be seen in any aerial photograph, and perhaps in the following example as well. The Corps of Engineers has been studying a proposed navigation canal entitled the "Bayou Barataria, Bayou Pecot Waterway" near the Barataria Bay in Jefferson Parish.[183] This particular canal would traverse 5.7 miles of marsh, the hypotenuse of a triangle formed by two existing waterways. Within this small triangle of coastal marsh, Corps of Engineers planners counted fifty-six miles of oil and gas access canals—or ten times the length of that proposed.[184]

Recognizing the existence of a large navigation canal system in the coastal zone, then, three corollaries seem inescapable. The first is that, however large this system is, it does not approach the cumulative extent of oil and gas access and pipeline canals throughout the same area. The second is that the two systems serve each other, in economic benefit and in environmental impacts. The last is that the dominant users of the navigation system, at first blush a separate set of works altogether, turn out to be companies engaged in some phase of the oil and gas industry.[185]

d. Canals, beaches, and the barrier islands

> Nowhere along Barataria's Gulf shore have coastal retreat and wetland deterioration taken on more severe proportions than at Eastern Grand Terre Island and Chenier Ronquille. This segment of the barrier system presently forms the weakest link in the protection of the Barataria estuary and adjacent wetlands. Shoreline retreat averages nearly 50 feet annually and is likely to accelerate in the near future as a result of imminent

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183. *Id.* at 108.

184. Conversation with a Member of the Environmental Assessment Branch, New Orleans District, U.S. Army Corps of Engineers (Apr. 22, 1983).

185. The documentation just presented casts a shadow over the oil and gas industry's assertion that "most of these canals do not serve the oil and gas industry; rather, they function in aid of navigation, drainage, land reclamation, trapping, and logging." Edwards, Zehner & Moore, *supra* note 162, at 260. The statement is simply unsupported by fact, research, or anything else located in this study. Oil and gas is the major user of the navigable waterway system, a major stimulus for its expansion, and the exclusive constructor of its own canal system, which, in mileage, cumulative width, spoil, maintenance, and every other indicator of adverse impact, dwarfs those of trappers, loggers, and all other activities named.

encounter with a series of pipeline canals paralleling the shoreline behind the present beach.[186]

Barrier beaches and islands[187] play a unique role in the retention of the Louisiana coast. As their name implies, they act as a first line of defense against the notorious coastal hurricanes[188] and other storms. They also regulate the amount and force of saltwater moving landward, and the salinity to which the marshes are exposed. These islands and beaches have been eroding at an alarming rate,[189] and here too canals and pipelines appear to be playing a noticeable, if less dominant, role.[190]

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186. COASTAL ENVIRONMENTS, INC., PROJECTS RECOMMENDED TO THE COASTAL MANAGEMENT SECTION OF DNR PURSUANT TO THE COASTAL ENVIRONMENT PROTECTION TRUST FUND 19 (1982) [hereinafter cited as PROJECTS RECOMMENDED].

187. Louisiana's barrier islands include from west to east: Isles Dernieres; Timbalier Islands; Grand Isle; Grand Terre Islands; Breton Island; and the Chandeleur Islands.

188. Hurricane Camille, for example, struck the Gulf coast in August of 1969 with increased wave heights of more than twenty feet. *Insurance and Other Programs for Financial Assistance to Flood Victims: Hearings Before the Senate Comm. on Banking and Currency*, 89th Cong., 2d Sess. 9 (1966). For a narrative history of the demise of a barrier island to a coastal storm, see J. SOTHERN, LOST ISLAND (1980).

189. Louisiana's barrier islands have dwindled to little more than half of their estimated size in the past century. *See* Penland & Boyd, *Assessment of Geological and Human Factors Responsible for Louisiana Coastal Barrier Erosion*, in PROCEEDINGS OF THE CONFERENCE ON COASTAL EROSION AND WETLAND MODIFICATION IN LOUISIANA: CAUSES, CONSEQUENCES, AND OPTIONS 14 (U.S. Fish & Wildlife Service, D. Boesch ed. 1982).

> Louisiana's coastal barrier systems are experiencing severe shoreline erosion and land loss. Between 1880 and 1980, total coastal barrier area decreased from 98.6 km^2 to 57.8 km^2, an overall loss of 41%. Coastal barrier land loss results from the natural processes of deltaic transgression and marine erosion, combined with the impact of human development.

Id.

> The barrier islands along the coast are eroding. In the Barataria hydrologic unit, Grand Isle and Grand Terre have been listed as areas of "critical erosion" by state and federal agencies studying erosion. Between 1960-1972, 71 ha (18 percent) of the principal Grand Terre Island was eroded away. Between 1932 and 1969 the average rate of barrier island erosion in the Barataria hydrologic unit was 20.2 ha/year. The rate of increase in the width of the tidal passes in the Barataria Bay area is increasing . . . .

Craig, Turner & Day, *supra* note 5, at 137.

190. Barrier islands erode naturally from a number of causes, most obvious among them the action of the sea. There is some evidence however that they also may be replenished by sands from the sea. As studies in this area continue, it can be said with certainty that the role of canals and pipelines is to exacerbate the situation and to accelerate the loss. *See* J. VAN BEEK & K. MEYER-ARENDT, *supra* note 17, and studies cited therein. Another threat to the barrier complex which protects coastal Louisiana has surfaced recently in the commercial dredging of shell reefs which have acted as storm barriers, as nursery grounds for shrimp and other fisheries, and as a measuring point for the projecting of Louisiana's three mile boundary. *See, e.g.*, Editorial, *Shell Dredging Con-*

Barrier islands, as well as barrier beaches not severed from the mainland, are apparently replenished in part by waterborne sands and sediments from inland sources.[191] The sediment that emerges from the larger rivers emitting into the Gulf is caught by longshore drifts moving either east or west and is deposited on the downdrift beaches, replacing sands torn away by other tidal action. Twelve major navigation channels, all of which serve the traffic of the oil and gas industry and several of which were constructed primarily to facilitate the passage of rigs and crewboats, bisect the Gulf shoreline in Louisiana.[192] Channel-training jetties are in place at eight of them; others are maintained by dredging. Longshore-transported sediment is intercepted by these jetties and accretes updrift from them. Downdrift barrier islands and beaches are deprived and erode more quickly.[193] As tidal inlets deepen and widen through time (in part the result of dredging and training jetties), decreasing amounts of longshore transported sediment are able to bypass the inlet, and downdrift areas are more completely starved.

Onshore canals work another effect on the barrier beaches and islands. As the wetlands behind barrier beaches and islands erode, more water is flushed in and out at greater velocity with each major tide. The enlarged currents of this "tidal prism" work on each of the islands more aggressively and erode them more quickly.[194] A canal dredged from the shore to a rig behind East Timbalier Island, for example, has developed into a major tidal inlet; average shoreline retreat rates of fifty-five feet per year are found here.[195] In this respect barrier erosion rates reflect the rates of erosion behind them.

Barrier islands and beaches have also felt the direct impacts of oil and gas canals. An inventory of twenty-two Louisiana barriers and beaches found ten of them transected by oil and gas canals, primarily pipeline channels.[196] Another more recent

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troversy, Times-Picayune/States-Item, Apr. 24, 1983, § 1, at 22.

191. *See* J. VAN BEEK & K. MEYER-ARENDT, *supra* note 17.

192. *Id.* at 14.

193. *Id.*

194. Turner, Costanza & Scaife, *supra* note 107, at 82.

195. J. VAN BEEK & K. MEYER-ARENDT, *supra* note 17, at 22.

196. R. Adams, P. Banas & R. Baumann, Shoreline Erosion in Coastal Louisiana, Inventory and Assessment (Louisiana State University, Center for Wetland Studies 1978) [hereinafter cited as Shoreline Erosion].

study of eight Louisiana coastal islands and beaches listed canals and pipelines as a problem for seven of them, and as a particularly major problem for four.[197] Pipeline and access canals destablize an island to an extent considerably greater than the simple volume of sand and spoil removed. On Grand Terre, for example, pipeline channels dredged behind the high-water line and behind the first line of beach have, in effect, removed the backing for the beach itself and markedly increased its erosion.[198] Several canals were observed acting as a sand sink, pulling the shoreline in retreat before the sea. The wetlands behind Chenier Ronquille have been so deepened and destroyed by channel cuts that it is feared that the island may sink out of

197. *See* J. VAN BEEK & K. MEYER-ARENDT, *supra* note 17, at 15. The following chart depicts the role of oil and gas activity and canalization on Louisiana coastal areas:

Hydrologic Unit	Name	Gulf Shore Description	Shoreline Length (miles)	Shoreline Retreat (ft/yr)	Oil & Gas Activity	Extensive Canalization
I	Chandeleur-Breton	Barrier Islands	41	32.8	--	--
II	Mississippi Delta	Active Delta	--	--	xx	x
III	Barataria	Barrier Islands & Beaches	52	27.2	xx	xx
IV	Terrebonne-Timbalier	Barrier Islands & Beaches	72	35.7	xx	xx
V	Atchafalaya	Active Delta	--	--	x	--
VI	Vermilion	Barrier Beach & Shell reefs	43	11.6	x	x
VII	Mermentau	Barrier Beach & Mudflats	54	30.3	xx	xx
VIII	Calcasieu-Sabine	Barrier Beach & Mudflats	46	8.9	x	x

198. *Id.* at 20.

sight when it retreats to the affected area.[199]

Perhaps the most immediately destructive of all channelization affecting the barrier islands is that occurring perpendicular to the beaches, laying open the body to the action of the sea. Small channels and inlets are soon enlarged. A major storm surge washes over the inlet and makes a new, permanent passage. Breton Island was severed in two in just such a fashion.[200] Similar washouts on Timbalier Islands, over canal sites long used and abandoned by the industry, are imminent.[201]

In the fashion described, the barrier islands and coastal subsidence are inextricably related. As the marshes disappear, the islands are rendered more vulnerable. As the islands diminish, the coast is made more vulnerable. Oil and gas activities are affecting both ecosystems, directly and indirectly, individually and cumulatively, and in two additional ways yet to be discussed.

e. Subsidence as a consequence of oil and gas extraction

> Subsidence produced by oil extraction is an increasing problem in some parts of the world.[202]

Coastal subsidence is a measurable fact.[203] The contribution of natural forces to subsidence is, as we have seen, also measurable, at least in terms of eustatic sea rise and historic subsidence rates.[204] The difference between natural and current rates of subsidence can be used to determine the impacts of man's activities on the system.[205] There is reason to believe that man's contribution to subsidence goes beyond the impacts of canals and levees already noted and includes the extraction of the subsurface itself, including the extraction of oil and gas.

The volume of oil and gas taken from below the coastal zone is impressive. In 1979, the average withdrawal of crude and condensate oil produced onshore in southern Louisiana was approx-

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199. Shoreline Erosion, *supra* note 196, at 69.
200. *See* J. VAN BEEK & K. MEYER-ARENDT, *supra* note 17, at 18.
201. *Id.* at 22-23.
202. GOODIE, THE HUMAN IMPACT—MAN'S ROLE IN ENVIRONMENTAL CHANGE (1981).
203. *See supra* pp. 12-16, section III(A).
204. *Id.*
205. *Id.*

imately twenty million gallons per day.[206] This figure represented an almost ten percent decline from 1978 production levels, and a longer term decline from the peak production levels of the early 1970's. In addition, over two billion mcf's of natural gas were produced from onshore gas fields in southern Louisiana.[207] If only the twenty million gallon per day figure were used to average oil extraction over the past forty years, Louisiana has lost 288 *billion* gallons from its subsurface to these operations since 1940.

The correlation of this extraction to subsidence is a more difficult proposition. Petroleum in nature is usually found in faults and traps between layers of sedimentary and more impermeable rock.[208] The effect of withdrawing these deposits depends on a number of variables, including the nature of the surrounding formations,[209] the method of extraction,[210] and the depths at which the production takes place.[211] While subsidence directly attributed to oil and gas drilling has been normally associated with shallow fields composed of unconsolidated sands,[212] production from depths as great as 8,000 to 9,000 feet have been shown to have influenced subsidence in regions as disparate as the state of California and the Netherlands.[213] In 1978, 1,286 wells were operating at an *average* depth of 11,088 feet in south Louisiana.[214]

The effects of oil and gas extraction on surface subsidence have been documented elsewhere in the United States and the

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206. Derived from statistics in the 1979 LA. ANN. OIL & GAS REP., DEP'T OF NATURAL RESOURCES, OFFICE OF CONSERVATION.

207. *Id.*

208. *See, e.g., A Brief Introduction in Scientific and Engineering Background of Oil and Gas*, in H. WILLIAMS, R. MAXWELL & C. MEYERS, OIL AND GAS 1-12 (1979).

209. For diagrams illustrating the range of formations in which petroleum deposits are found, see *id.* at 3.

210. Primary extraction relies on subsurface pressures to force oil to the surface; secondary extraction involves the injection of water or other materials to surface the deposits. *Id.* at 9-11.

211. Telephone interview with Professor Robert Baumann, Center for Energy Studies, Louisiana State University.

212. *Id.*

213. *See* Erickson, *Subsidence Control and Urban Oil Production—A Case History, Beverly Hills (East) Oil Fields, California*, and Schoonbeck, *Land Subsidence as a Result of Gas Extraction in Gramingee, The Netherlands*, in PROCEEDINGS OF THE ANAHEIM SYMPOSIUM. INT'L ASS'N OF HYDROLOGICAL SCIENCES PUBLICATION 121 (1976).

214. LOUISIANA DEP'T OF NATURAL RESOURCES, OFFICE OF CONSERVATION, SUMMARY OF FIELD STATISTICS AND DRILLING OPERATONS, LOUISIANA (1978).

world. One survey of this evidence concludes:

> The classic area is Los Angeles, where 9.3 m of subsidence occurred as a result of exploitation in the Wilmington oil field between 1928 and 1971. The Anglewood oilfield displayed 2.9 m of subsidence between 1917 and 1963. Some coastal flooding problems occurred at Long Beach because of this process, while in Japan this has not emerged as a major problem. In 1960 only 35.2 km of Tokyo lowland was below sea level, but continuing subsidence meant that by 1974 this had increased to 67.6 km, exposing a total of 1.5 million people to major flood hazards. Similar subsidence is known from the Lake Maracaibo field in Venezuela and from some Russian fields.[215]

The Goose Creek Oil Field in East Houston, Texas, has also experienced six feet of subsidence at some locations, attributed to oil and gas withdrawals.[216]

This evidence and the volume of extraction in Louisiana notwithstanding, there is little published research on the effects of oil and gas development on subsidence in Louisiana.[217] While several studies reference the withdrawal of oil and gas as contributing to subsidence,[218] the best documentation of subsidence in the state is associated with the removal of subsurface water.[219] Between 1964 and 1969 an industrial area near Baton Rouge, Louisiana, sank an average of three feet. Water was being extracted, at the time of study, at the rate of 110 million gallons a day. In two isolated incidents of subsidence that occurred outside the principal center of pumping activities, the regression coincided with the operation of additional, individual water-well

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215. GOODIE, *supra* note 202, at 203 (citations omitted). The author provides the following graph:

Ground subsidence caused by O&G Extraction

Location	Amt.	Years	Rate (mm/yr)
Azerbaydzhan, USSR	2.5	(1912-62)	50
Atravopol, USSR	1.5	(1956-62)	125
Wilmington, USA	9.3	(1928-71)	216
Inglewood, USA	2.9	(1917-63)	63

216. *Id.* at 204.

217. *See* Shoreline Erosion, *supra* note 196, at 6.

218. *Id.*

219. W. WINTZ, SUBSIDENCE AND GROUND WATER OFFTAKE ON THE BATON ROUGE AREAS, LOUISIANA WATER RESOURCES RESEARCH INST., BULL. NO. 6.

fields. The study concluded that the depletion of the aquifers was causally connected to the subsidence, and that if net off-take from the aquifers was not reduced immediately the total subsidence in the center of the industrial area could reach five feet or more by 1990.[220] Results similar to these have been found in Florida, Texas, and in countries abroad.[221] When the subsurface is removed, land tends to settle to fill the void.

The analogy of oil to water is of course an imperfect one. Water is, among other things a denser substance, found in different formations often close to the surface. On the other hand, oil and gas deposits are found under pressure so strong that it will often propel the reserves to the surface;[222] extraction of oil and gas removes not only a volume of subsurface material but also the pressure in that formation. In the absence of more direct studies addressing the subsurface effects of oil and gas extraction on the Louisiana coast, these effects may never be proven. One author has noted that subsidence rates along the Gulf Coast increased significantly around 1959.[223] This observation correlates to the full-scale production of oil and gas from the Louisiana coastal zone.

From the information available, then, an inference of a causal connection between oil and gas extraction and subsidence is a logical one. There are a variety of assaults contributing to subsidence in south Louisiana however, and a paucity of research on extraction as a sole contributor. The evidence, while considerable, remains circumstantial.

f. The effects of oil and related pollution

> Chronic pollution from oil, bleed water, and oil-emulsion drilling muds should be considered an associated effect of normal petroleum industry activities. Even in the best-regulated production areas, light to moderate oil slicks are common, bleed

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220. *Id.*

221. *See, e.g.*, Haberman, *A Steamy, Crowded Bangkok is Sinking Closer to Sea Level*, N.Y. Times, May 1, 1983, at 1, col. 1. Over 11,000 separate water wells are apparently operating beneath Bangkok which, at this rate of withdrawal, is expected to subside below sea level within twenty years.

222. *See* H. Williams, R. Maxwell & C. Meyers, *supra* note 208, at 11.

223. Swanson & Thurow, *Recent Subsidence Rates Along the Texas and Louisiana Coasts as Determined from Tide Measurements*, 78 J. Geophysical Research 2265-671 (1973).

> water is released, equipment malfunctions and operating practices may be careless, resulting in a continuing, low level of pollution.[224]

The discharge of oil and associated wastes is another well-documented by-product of oil and gas activities in the coastal zone. The magnitude of these discharges in any given year is impressive. Their effects on animal and plant life, at least for the short term, are adverse and serious. The long-term effects, however, remain more difficult to assess. No firm quantification of these effects can be attempted here. What is possible instead is to indicate the size of the problem and its potential for harm to an ecosystem that is, for reasons stated above, already under heavy stress.

Much of the information and controversy concerning oil pollution and its effect on marine environments have arisen from a few oil spills of considerable size but limited duration. These spills have come from such celebrated tanker disasters as the Torrey Canyon[225] and the Amoco Cadiz,[226] and from equally well publicized oil field "blowouts" such as the one near Santa Barbara, California in 1979[227] and the more recent Ixtoc I well blowout in Mexico's Campeche Bay.[228] Follow-up studies have provided evidence that, while the temporary effects on coastal ecosystems may be devastating,[229] once the event has passed the systems have recovered to near those conditions which had ear-

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224. St. Amant, *The Petroleum Industry as it Affects Marine and Estuarine Ecology*, J. PETROLEUM TECH., Apr. 1972, at 385, 390.

225. *See* E. COWAN, OIL AND WATERS: THE TORREY CANYON DISASTER (1968).

226. The Amoco Cadiz released 1.5 million barrels of crude oil into the environment, a record amount until the more recent Ixtoc I incident. *See* Note, *Trouble Over Oiled Waters: Pollution Litigation or Arbitration—The Ixtoc I Oil Well Blow-Out*, 4 SUFFOLK TRANS. L.J. 281, 282 (1980). A recent study by the U.S. National Oceanic and Atmospheric Administration places the total costs of this one spill at between $190 million and $290 million. *Water Pollution*, [Current Developments] 13 ENV'T REP. (BNA) No. 25, at 1069 (Oct. 21, 1983).

227. *See* Walmsley, *Oil Pollution Problems Arising Out of Exploitation of the Continental Shelf: The Santa Barbara Disaster*, 9 SAN DIEGO L. REV. 514 (1972).

228. *See Hearings Before the House Comm. on Merchant Marine and Fisheries and the Subcomm. on Water Resources of the House Comm. on Public Works and Transportation on the Impact of the Blowout of the Mexican Oil Well Ixtoc I and the Resultant Oil Pollution on Texas and the Gulf of Mexico*, 96th Cong., 1st Sess. (1979).

229. *See, e.g.*, Puerto Rico v. SS Zoe Colocotroni, 456 F. Supp. 1327 (D.P.R. 1978), *aff'd in part and vacated in part*, 628 F.2d 652 (1st Cir. 1980), *cert. denied*, 450 U.S. 912 (1981) (discussing the effects from the spill of the SS Zoe Colocotroni on a coastal lagoon off Puerto Rico).

lier prevailed.[230] While no such disasters have yet come to Louisiana and their effects on the state's estuarine systems thus remain largely conjectural, at least one Louisiana authority has drawn an optimistic conclusion: "[S]uch [major] accidents do not represent the true impact of the petroleum industry on the basic marine ecological conditions, nor is there much evidence after the hue and cry that they actually affected the environment to any great degree or permanently."[231]

As this statement indicates, however, there is another impact to be reckoned with. Undue attention to the headlined, single-event disasters may mask the problem of the recurring introduction of oil and other wastes into the marine environment on a cumulative basis.[232] In fact, it is this chronic, low-level oil pollution that should be the first concern to those who would address the coastal environment.[233]

As oil production levels have, until very recently, increased in Louisiana, so have the amounts of production-associated pollutants discharged into coastal waters. One study that examined the Leesville Oil Field, a typical coastal production area, found that "[s]mall but relatively periodic spills occur from pipeline leaks, overflow of asphalt holding tanks, well maintenance, and drilling operations. These inputs are difficult to quantify but probably constitute a significant source of petroleum into this environment."[234] That same study reported that six million barrels of brine water, which contains saturated concentrations of oil, were being pumped into the environment surrounding that

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230. It should be noted, however, that the residual, sub-lethal effects of even these "one-shot" spills are not well known, and it cannot be said with confidence that long-term effects will not be identified in the years ahead.

231. St. Amant, *supra* note 224, at 385.

232. *See* Milan & Wheland, *Accumulation of Petroleum Hydrocarbons in a Salt Marsh Ecosystem Exposed to Steady State Oil Input*, in PROCEEDINGS OF THE THIRD COASTAL MARSH AND ESTUARY MANAGEMENT SYMPOSIUM 65, 66 (J. Day, D. Culley, R. Turner & A. Mumphrey eds. 1978) ("[The effects of low level oil pollution] are . . . not as well known [as the instantaneous effect of an oil spill on specific organisms]. Even though their effects are not readily noticable [sic], the accumulative effects may impose a significant environmental stress.").

233. St. Amant, *supra* note 224, at 390.

234. Milan & Wheland, *supra* note 232, at 80. The great majority of spills in the Gulf of Mexico are small ones; approximately 99% are less than fifty barrels, and 85% are less than one barrel. Nonetheless, Gulf pollution is heavy, with 1,547 spills reported in 1982 totalling 522,729 gallons of oil. Poe, *Commercial fishing lucrative industry*, Times-Picayune/States-Item, Nov. 9, 1983, § 1, at 10, col. 3.

oilfield each year, the brine itself increasing salinity levels in addition to the effect of its contaminants.[235] When several hundred fields operate in this manner throughout the coastal zone, on a daily basis over a period of many years, the challenge to water quality and plant and marine life becomes obvious.

To give the discussion a more quantitative flavor, the scale of this pollution should be appreciated. According to the United States Coast Guard,[236] Louisiana led all states in both the number of oil spills reported and the volume of oil spilled for calendar years 1980 and 1981.[237] During that two-year span, 3,255 separate incidents of oil spillage were reported, with over fifteen million gallons of oil released into Louisiana waters.[238] In 1981 more than 12.5 *million* gallons were spilled in Louisiana.[239] To these statistics can be added an unknown number of spills not observed by regulatory agencies or reported by dischargers. The statistics, therefore, may well be low. As a bottom line, however, they are by no means insignificant.

The effect of releases of this magnitude will depend on such

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235. *Id.* The discharge of brine from oil extraction is a separate and potentially serious consequence for the Louisiana marshes, particularly for wells producing in freshwater and brackish marsh ecosystems. Waters of extremely high salt content, as much as 25% or seven times the salinity of seawater, are normally found in oil and gas deposits. *See* H. WILLIAMS, R. MAXWELL & C. MEYERS, *supra* note 208, at 9; MIDDLEDITCH, ENVIRONMENTAL EFFECTS OF OFFSHORE OIL PRODUCTION: THE BUCCANEER GAS AND OIL FIELD STUDY 22-24. In secondary recovery, the brine which is brought to the surface may be reinjected into the well to surface additional petroleum resources, creating something of a closed system for these waters. In primary recovery, however, which in 1979 constituted 78% of all of the production method for Louisiana, and a larger share still of that in the coastal marshes, the oil and gas are separated from the brine waters which are then discharged. Brine discharges are to be regulated, *inter alia*, to ensure against the destruction of "any fish life, or any beneficial animal or vegetable life" in the discharge area. *See* Louisiana Stream Control Comm'n, Rules Governing Disposal of Waste Oil, Oil Field Brine, and All Other Materials Resulting From the Drilling for, Production of, or Transportation of Oil, Gas or Sulphur (Jan. 27, 1953). A serious question has been raised concerning the effectiveness of these regulations in practice. Among others, the State of Louisiana apparently has at present no system for permitting the discharge of brine from oil and gas operations. *See, e.g.*, Letter from J. Dale Givens, Administrator, Water Pollution Control Division, Office of Environmental Affairs, Department of Natural Resources, to James L. Isenogle, Jean Lafitte National Historical Park (May 15, 1983). Nor does it have information on the volume of brine discharged in a given area. *Id.*

236. UNITED STATES COAST GUARD, POLLUTING INCIDENTS IN AND AROUND U.S. WATERS: CALENDAR YEARS 1980 AND 1981, at 36-37 (1982).

237. *Id.*

238. *Id.*

239. *Id.*

variables as their location, intensity, and coincidence with critical growing periods.

> In shallow-water enclosed lakes and embayments, and especially in flooded marshes, the problems are more serious. Slower tidal exchanges and smaller volumes of water tend to prolong the ill effects and to intensify the pollution per unit of oil lost. Coating of the local substrata, vegetation, and animals may cause significant animal and plant mortality.[240]

The salt marshes of coastal Louisiana are dominated by the presence of smooth cordgrass, *Spartina alterniflora*. Smooth cordgrass has been recognized as an effective source of erosion control.[241] A similar species of cordgrass, *Spartina anglica*, has been the subject of studies of the role of erosion in the marsh ecosystem:

> This species of grass [*Spartina anglica*], with its rhizomatous root system and extensive aerial shoots, stabilises soft marine mud and helps trap further silt to raise the marsh level. . . . This process, which allows invasion of the area by other less salt-tolerant plants, thus changes the biology of the area, and is called succession.[242]

The effects of oil pollution on coastal erosion, then, concern largely its chronic impacts on marsh cordgrass.

Generally speaking, the harmful effects of oil on living organisms may be divided into physical effects and chemical effects.[243] Physical effects are caused by coating the organisms and their immediate environment with oil, leading to death by simple asphyxiation. Chemical effects of oil vary with the components involved. Low boiling point aromatic hydrocarbons are the most highly *toxic*, and their greater water solubility tends to increase their distribution across the marsh and their uptake by aquatic vegetation.

Recent studies have shown that cordgrass is susceptible to

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240. St. Amant, *supra* note 224, at 387.

241. *See* 1 J. Gosselink, An Ecological Characterization Study of the Chenier Plain Coastal Ecosystem of Louisiana and Texas, FWS/OBS-78/9 (U.S. Fish & Wildlife Service Office of Biological Service, Washington, D.C. 1979).

242. Dicks, *The Effects of Refinery Effluents: The Case History of a Saltmarsh*, in Marine Ecology and Oil Pollution 227 (J. Baker ed. 1976) (citations omitted).

243. This general discussion is drawn from J. Duffus, Environmental Toxicology 94-97 (1980).

both the negative physical and chemical impacts of oil pollution. "[C]omplete coverage of plant surfaces, irregardless [sic] of oil type, caused mortality. Death of *Spartina alterniflora* due to oiling may be related to such factors as the absorption of light for photosynthesis, interference with gaseous exchange, reduction of transpiration, inhibition of translocation, and damage to cell membranes."[244] Lesser exposures to oil, such as only to the lower plant surfaces, resulted in lower mortality figures, depending upon the gradient of oil involved.[245]

Studies of *Spartina anglica* cordgrass in England reached similar conclusions. One study found that cordgrass is sensitive to oil pollution, especially to films of oil on the water surface. Some of the reasons for marsh plants' sensitivity to oil include:

> (a) There is a high affinity between plant cuticle and oil hydrocarbons. This encourages adhesion of oil to vegetation.
> (b) Oil obstructs the leaf pores (stomata) and prevents or restricts gas exchange to root and shoot.
> (c) Oil films reduce the light available for photosynthesis.
> (d) Some constituents of crude oils are directly toxic to metabolic processes.[246]

In all marsh systems, nature recovers far more easily from a single event than from repeated, lethal and sub-lethal, doses. This is especially true of marsh vegetation such as cordgrass. If the oiling occurs during the vegetation's growth stage, the spring and summer, then the uptake of toxic oil pollutants in those plants will be greater. The result may be severe stunting or a local dieback. If a sufficiently large number of plants die, their interlocking root system deteriorates, soil more easily erodes, and substrate for new growth disappears. All of these effects result in a transition from marshland to open water.

One Louisiana commentator has noted that in some areas surrounding oil and gas production facilities, "small biological deserts" have been caused by "local bleed water" and oil pollution.[247] One well-documented study presents the effect of an oil

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244. Alexander & Webb, *Effects of Oil on Growth and Decomposition of* Spartina Alterniflora, in 1983 Oil Spill Conference 532 (1983).

245. *Id.*

246. Dicks, *supra* note 242, at 229.

247. Rizne, J. Petroleum Geology, at 390. The captioned photograph reads: "Small biological desert caused by localized bleed water and polluting oil near produc-

refinery's outflow into an adjacent salt marsh over a twenty year period from 1950 to 1970.[248] During that span, the area changed from one dominated by healthy *Spartina anglica* to one characterized by bare mud with only the scattered remains of *Spartina anglica* stems and roots showing. "At the edge of the denuded area was a belt of oily vegetation behind which the marsh was healthy. *The mud level in the denuded area was 15-25 cm lower than the healthy marsh, presumably due to erosion.*"[249] The conclusions reached by the study were that:

> (a) the damage to the marsh was due to repeated light oilings of the vegetation and shoots from films of oil stemming partly from the effluent and partly from spillages, and
> (b) recolonization would be prevented by the continual presence of these films, though the mud itself, whilst containing variable amounts of oil, was not toxic and growth of *Spartina anglica* occurred in samples of the mud in the laboratory.[250]

The biological mechanisms by which chronic low level oil pollution leads to localized subsidence are clear. The primary adverse effects of oil on marsh systems are not those of infrequent major disasters. They are, rather, those of a continuous discharge of pollutants over long periods of time. The scale of the discharge in south Louisiana is large. Its effects on marshland vegetation, which is so important to resisting erosional forces, is undeniably negative. It would be interesting to know, in terms of acreage lost, exactly how negative. Until that information is at hand, if indeed it ever can be, it is sufficient for purposes of this study to identify pollution as another unintended but unfortunate by-product of oil and gas activities in the coastal zone.

4. *Le Tout Ensemble*: Towards an Understanding of the Total Impacts of Canals, Pipelines, and Associated Activities

With this understanding of the processes of oil and gas activities and erosion, it should be no surprise that considerable evidence show them to be, in the aggregate, the predominant factor in coastal subsidence. The evidence is by its nature con-

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tion facilities." *See also* Milan & Wheland, *supra* note 232, at 66.

248. *See* Dicks, *supra* note 242, at 230.

249. *Id.* at 231 (emphasis added).

250. *Id.*

servative because, by the time it has been gathered, analyzed, and reported, new canals have been dug and the existing thousands have caused further erosion. Estimates of the total, cumulative damage have been made, however, from field studies of specific and rather large coastal sites, from aerial photographs of these same and other areas, from statistics on dredge and fill permits issued for the coastal zone, and from extrapolations from known canal densities and rates of erosion.[251]

Field studies in conjunction with topographic map surveys provide one basis for identifying the overall effects of oil and gas canals on the coastal zone. Analysis of the Barataria Bay estuary drew the following conclusions:

> In a 1939 topographical map, 54 miles of man-made channels associated with drainage, logging, reclamation and trapping appear. In the next 9 years, no new canals were added to these systems. However, 46 miles of oil and gas canals appeared. By 1962, an additional 156 miles of well access canals had been constructed, a greater than 300% increase or an average of 11 new miles of canal per year. By 1968, only 32 miles of canals had been added to the oil and gas fields for a rate of 5 miles per year, indicating that perhaps the existing 234 miles of canals were enough. It is apparent that the oil and gas industry, in the last 20 years, has been responsible for the expansion of the canal system, accounting for 77% of the man-made waterways appearing on the 1968 map.[252]

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251. Omitted from this discussion, for reasons of space, are two additional oil and gas activities of substantial size and impact on the coastal zone. The first is the Louisiana Offshore Oil Port (LOOP), which will claim 600 acres of marsh for the facility siting and will require 1,100 acres in additional development, 5,300 acres in refinery expansion, and 1,100 for other industrial siting in the coastal zone. *See* Stone & Hinchee, *Environmental Challenges of Superport Development in Coastal Louisiana*, 3 ENVTL. MGMT. 453 (1979). Also omitted is the Strategic Petroleum Reserve, a complex of three subsurface petroleum storage sites and a network of pipelines through the central and western coast. *See generally* U.S. DEP'T OF ENERGY, STRATEGIC PETROLEUM RESERVE, ANNUAL REPORT (Feb. 16, 1981).

252. *See* D. Davis, *supra* note 88, at 156. For a similar conclusion on the effect of canals on the Barataria Bay estuary, see Craig, Turner & Day, *supra* note 5, at 242 (citations omitted):

> Canal density is a rough approximation of one type of marsh management and canals are the dominant form of man's alterations of the Barataria Bay estuary. The composite map . . . was digitized to estimate land losses in each of the nine coastal hydrological units. These were compared to canal density measured by [one authority]. Secondly, [another authority's] data for land loss is directly proportional to canal density for each example. Notice that the intercept of the regression equation for the data is similar (.10 vs .074 percent land

In the Leeville Oil Field of Lafourche Parish, other field research shows the same pattern. The total marsh area declined from 71.3% of the surface area to 55.9% between 1952 and 1969.[253] Petroleum related canals jumped from 4.8 to 14.6% in their surface area alone, with associated spoil banks adding another 5.4 to 15.2%, for a net loss increase of 20.6%. Similarly striking data are available for the West Bay Oil Field: marsh area declined from 49.7 to 25.4%; oil and gas canals increased from 4.4 to 14%; spoil banks rose from 2.9 to 6.9%.[254] These measurements do not include the continuing indirect effects of

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loss yr^{-1}.) and that land loss rates are several times higher than that due to canal density. We believe that this intercept is probably as good an estimate as we can now generate of the actual land losses due to changes in land elevation relative to sea level. Canals appear to promote land loss in a predictable manner.

253. Gagliano 1973, *supra* note 77, at 78. The following table tells the story of land loss in the Leeville Oil Field.

Changes in Surface Environments in the Leeville Oil Field, 1952-1969. Data from Comparison of Aerial Photographs.

Environment	% Surface Configuration* 1952	1969
Marsh	71.3	55.9
Tidal streams	4.9	3.2
Lakes and ponds	11.8	7.0
Navigation channels	1.0	2.9
Petroleum access canals	3.2	9.2
Petroleum rig cut canals	1.6	5.4
Spoil banks	5.4	15.2
Highways (including embankments)	.8	1.2
	100.0	100.0

Environment	Length in miles 1952	1969
Canals	30.2	65.3

*Total surface area of photo coverage = 22.8 mi.

Id.

254. *Id.* at 81.

freshwater impoundment, saltwater intrusion, and spoil bank erosion.

Inspection of aerial photographs confirms the impacts of these canals on the coast.[255] One analysis, now dated by ten years, concluded that mineral extraction activities accounted at that time for 65% of the total dredging occurring, with drainage canals at 21% and navigation canals at 11%.[256] A 1969 report indicated that more than 10% of the total acreage of the coastal parishes was underlain by oil and gas deposits;[257] it is now clear that considerably more surface area than that will be modified by exploration and production activities, excluding the additional requirements of tanker and pipeline transport.

Map analysis of cumulative land losses in several coastal parishes also shows the direct correlation between these canals and subsidence. In Jefferson parish for one studied year, 1969,

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255. *Id.* at 77, 80. The conclusions drawn by this study are supported by photographs showing the influx of canals and the conversion to open water in each of these oil fields between 1952 and 1969. While the photographs are their own "best evidence," the following captions provide a sense of what they depict:

> Figure 29. Comparative aerial photographs of the Leeville oil field, Lafourche Parish, Louisiana, 1952 and 1969. The area is located along the old Bayou Lafourche distributary of the Mississippi River. This is an abandoned delta lobe which is undergoing gradual natural deterioration. The marsh surface in 1952 was still largely unbroken, but by 1969 a number of ponds had appeared. . . . Tidal channels . . . show little change. Bayou Lafourche . . . serves as a major artery for both fishery and petroleum industry vessels. The intricate web of canals dredged for drilling rig acccess and production activities was already under development in 1952 but has been greatly expanded since that time.

Id. at 76.

> Figure 30. Comparative aerial photographs of the West Bay oil field, Plaquemines Parish, Louisiana, 1952 and 1969. . . . The field is located in the lower western margin of the West Bay subdelta. This area has undergone drastic land loss through subsidence during the last 20 years. The marsh surface has become drowned, and only narrow bands of relatively high natural levee ridges remain . . . . Bays in the interdistributary areas . . . are rapidly expanding. Areas with well-developed tidal stream networks . . . located near major distributaries have experienced the least amount of land loss through erosion. The margin of the landmass bordering the Gulf of Mexico . . . is deteriorating rapidly in most places.
>
> Even though this area is undergoing rapid natural change, the most obvious difference between the two photographs is the development of the extensive web of canals and spoil banks associated with the petroleum industry. In addition to the canals, note waste disposal pits . . . and oil storage tanks . . . .

Id. at 79.

256. *Id.* at 102.

257. *Id.* at 82.

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there was a total land loss of 10.9 square miles, 5.71 square miles of which were directly converted to water by oil and gas activities, accounting for more than 50% of the loss.[258] In Lafourche Parish, of a total land loss of 33.96 square miles, 12.72 square miles, or 37%, was attributable to the direct impact of oil and gas activities. In Plaquemines Parish, of a total land loss of 10.84 square miles, 9.39 square miles, or 86%, was attributable to oil and gas. Since only direct impacts were taken into account in these statistics, the actual contribution to land loss is considerably higher.

Records from permits issued for dredging and filling in the coastal zone provide another indication of at least the rate at which new canals are being dug. An analysis of permit data from the Louisiana Department of Wildlife and Fisheries indicated that "of the roughly 2,000 permits granted in 1974, 57% of them were oil and gas related."[259] A more recent U.S. Fish and Wildlife Service study[260] shows that, for 397 permits for dredging of Louisiana marshes by oil companies in 1975, 1,907 acres of marsh were taken directly by the proposed channel area. In 1976, 435 oil and gas permits resulted in a direct loss of 2,424 acres. In the first half of 1977, 206 permits took another 1,295 acres. From these permits alone there was a marsh loss of 5,626 acres to oil and gas canals. If these figures are adjusted to account for actual canal size, doubled for the effects of spoil, and doubled again for the projected effects of erosion and impoundment, the losses exceed 30,000 acres from activities permitted during one two-and-one-half year period.[261]

Evidence from these studies and their implications on land loss has been slow to reach public attention. The research is relatively new. One of the first comprehensive estimates, made in 1970, concluded that of the 16.5 square miles of coastland then being lost yearly, 25% of the loss was directly attributed to oil and gas canals.[262] Since that time, of course, the rate of erosion

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258. These and the parish statistics which follow are taken from Adams, *supra* note 20, at 13.

259. Stone, Bahr, Day & Turner, *supra* note 101, at 13.

260. Day & Craig, *supra* note 110, at 236. For additional analyses of permits indicating the rapid pace of "canalization" in recent years, see discussion of the federal and state regulatory programs *infra* pp. 132-38, Section V(C)(1).

261. Day & Craig, *supra* note 110, at 236.

262. Data analyzed in this study indicate that dredging related to the petro-

has tripled, as has our scientific knowledge of the effects of canals on the marsh. The more science learns, the greater is its estimate of the canal builder's role. Each new study adds to the data base, and each study raises the estimated share. Indirect losses appear to be the major reason for the increasing coastal loss rates; as noted earlier, canal surface area accounted for 39% of the total coastal zone land loss in the early years of oil and gas exploration; since 1955, despite the boom in new canal construction and the resulting boom in new surface area, this factor accounted for less than 10% of the loss.[263] Secondary effects, cumulative, and time-delayed effects, are taking hold.

In the meantime, the area of new canals added each year increases. The surface area of these canals has doubled in the past fifteen years. One researcher concludes: "Now [1982], land loss rates are near 1% annually. This translates to a regional 'half-life' of 50 years. There is no indication that trends in either canal density or land rates is [sic] changing in Louisiana."[264] Another study concludes: "It is doubtful that the Louisiana coastal zone can sustain another 30 years of attrition through canal dredging at the present rate."[265] These predictions of the consequences of oil and gas activities on the coastal zone incorporate and are consistent with every published study on the problem in the past decade.[266]

The findings of all of these studies have been most recently corroborated by research focused on the net contribution of

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leum industry has been a major contributor to land loss and marsh deterioration in coastal Louisiana during the past 30 years. Map studies show that approximately 16.5 square miles of land were lost each year in the coastal zone during this 30-year period . . . . Approximately 25% of this loss can be accounted for as a direct result of petroleum industry dredging.

Gagliano 1973, *supra* note 77, at 90 (citing Gagliano & van Beek 1970, *supra* note 20).

263. *See supra* pp. 33-37, Section III(C)(3)(a).

264. Turner, Costanza & Scaife, *supra* note 107, at 75.

265. Gagliano 1973, *supra* note 77, at 99.

266. *See* studies cited *supra* note 110. The oil and gas industry cites three primary authorities for the proposition that oil and gas activities have had minimal impact on the coastal zone. Edwards, Zehner & Moore, *supra* note 162, at 259-62 & nn. 153-58. One is Dr. Gagliano, whose one study, directed to the impacts of oil and gas canals, concludes precisely the opposite. Gagliano 1973, *supra* note 77, at 100-01. The second is an unpublished graduate thesis which is said to describe the "benefits" of spoil banks to the coastal marshes. J. Monte, *supra* note 162. For a discussion of these " benefits," see *supra* note 162. The third is the statement of a Louisiana governor.

canals to subsidence.[267] Comparing rates of loss in areas of relatively untouched marsh, where it can still be found, to rates of loss in areas of varying canal density, the study concludes:

> In general, where canal density is high, land losses are high; where land losses are low, canal densities are low. Further, the land loss rates at zero canal density for all six regions [of the Louisiana coast] average $0.091 \pm 0.139\%$ annually (mean $\pm$ std. dev.) or about 11% of the overall land loss rates from 1955 to 1978 (0.8% annually) for the whole coast. The implication is that this annual rate of 0.09% represents the combined influence of all factors except canals. *Canals, therefore, may be responsible for 89% of the total land losses.*[268]

Should nothing else persuade, this research is all but conclusive. It is the product of field measurements, not hypothesis. It shows subsidence to be directly proportionate to canal density. On this basis, the oil and gas industry can be seen as a dominant, if not the predominant, factor in coastal land loss. It remains to be seen what consequences these losses portend for Louisiana and what if anything can be done about them.[269]

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267. *See* W. Scaife, R. Turner & R. Costanza, *supra* note 110.

268. *Id.* at 10-11 (emphasis added). Two graphs from earlier studies summarize the relationship of canal diversity to land loss. The first depicts the increase in canal density:

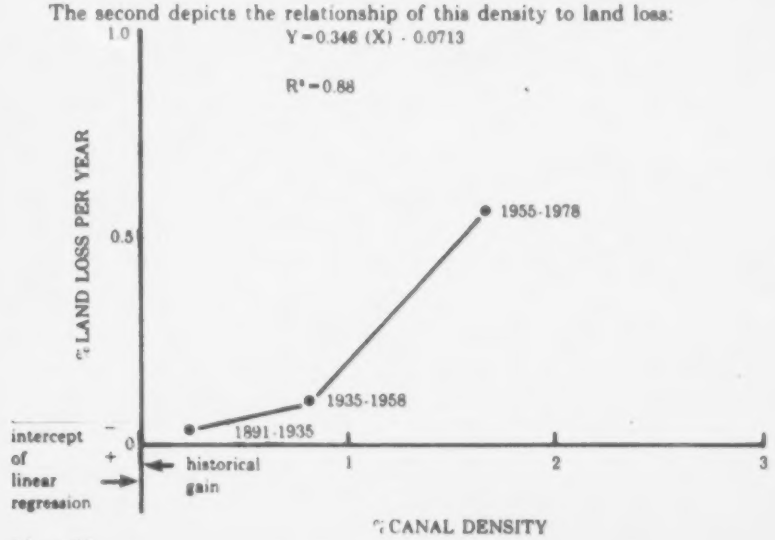
Turner, Costanza & Scaife, *supra* note 107, at 75.

IV. CONSEQUENCES

> The walrus and the Carpenter
> were walking close at hand:
> They wept like anything to see
> such quantities of sand.
> "If this were only cleared away,"
> They said, "it *would* be grand!"[270]

The consequences of the loss of coastal Louisiana to the state and to the United States are not easily summarized. Before turning to those actions that might be taken to avert these losses however, some appreciation of their scope and nature is in order—if only because they have tended to be overshadowed by the more obvious and immediate benefits of navigation and oil and gas production.

The second depicts the relationship of this density to land loss:



Id. at 76.

269. On September 28, 1983, a consortium of more than nineteen oil and exploration companies announced the construction of a $4.3 million exhibit at the New Orleans World's Fair. The pavilion features a 142-foot oil rig, the tallest structure on the fairgrounds. At its base is a 50,000 gallon saltwater aquarium, stocked with fish. The theme will be "Where Oil and Water Meet." Times-Picayune/States-Item, Sept. 28, 1983, § 1, at 15, col. 1.

270. L. CARROLL, *Through the Looking Glass*, in THE COMPLETE WORKS OF LEWIS CARROLL 184 (1936).

A. On the One Hand: Oil, Gas, and Navigation

Navigation looms large in the history of Louisiana. The passage of ships has been, until the recent oil, gas, and petrochemical boom, the shaping force of the state. The Port of New Orleans is the largest seaport in the United States and the world's second in waterborne tonnage.[271] Fifty linear miles of dock facilities line both banks of the river. Over a hundred steamship lines represented by at least forty agencies sail from New Orleans to all points on the globe. These and other maritime-related businesses employ over 50,000 people.[272]

The navigation and port complex is not restricted to the New Orleans area. More than a dozen separate Louisiana waterways carry traffic ranging from 3,000 to 78,000,000 tons annually, excluding commerce through New Orleans, Baton Rouge, and Lake Charles, with a total of 110,537,000 tons in 1976.[273] The lower Mississippi River navigation complex—from Baton Rouge to the Gulf of Mexico—adds another 466.5 million tons, giving Louisiana waterways one-third of all waterborne tonnage in the United States.[274] On the basis of foreign trade alone, and excluding petroleum, the value of Louisiana's water commerce has been estimated at over $9 billion a year.[275]

Added to these already enormous stakes are those of the oil and gas industry. In 1976, Louisiana produced almost 260 million barrels of crude oil from its coastal waters, with almost 272 million barrels more from federal waters beyond the three-mile limit.[276] These numbers placed the state second in the nation in oil production with 19% of its total, valued at $6 billion.[277] To these sums another 6.9 million cubic feet of natural and casing head gas were added in 1976, largely from the coastal zone.[278]

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271. DEEP DRAFT ACCESS, *supra* note 9, at 23. The ensuing figures on the Port of New Orleans come largely from this study.

272. DRAFT ENVIRONMENTAL IMPACT STATEMENT, LOUISIANA COASTAL RESOURCES PROGRAM, *supra* note 164, at 29.

273. *Id.* at 32 (citing the U.S. Army Corps of Engineers).

274. *Id.* at 30.

275. *Id.* at 31. This estimate is predicted on annual tonnage, excepting petroleum, of 129 million tons, and calculations that each ton of trade is valued for its direct and indirect benefits at $70.

276. *Id.* at 28.

277. *Id.*

278. *Id.*

The combined production of oil and gas in Louisiana created more than 46,000 jobs in the coastal parishes in that year,[279] approximately half of these from federal outer continental shelf activity.[280] Oil and gas revenues to the State of Louisiana in 1983 have been placed at $875 million.[281]

The combined values of the navigation and oil and gas industries in Louisiana are enormous, amounting to a figure well in excess of $15 billion a year.[282] The values of these industries are in at least one major respect, however, dissimilar. Navigation is—at the considerable cost of initial construction, expansion, and maintenance—a somewhat renewable operation. The demand for these shipping services, however affected by economic cycles and the recession of the early 1980's, will continue for the foreseeable future.[283] The future of oil and gas production is more dimly perceived. Excluding production from federal waters, Louisiana's petroleum production has declined gradually but steadily, as have known reserves, for a decade.[284] As early as 1976, predictions were made that state revenues from oil and gas would drop from forty-eight percent to twenty-eight percent in 1980.[285] State revenue generated in the early 1980's appears to bear out this prediction.

From this data several observations appear plain. To begin, these are industries of such enormous value to the state and to the nation that thoughts of arresting them are in the realm of fancy. As a corollary, however, the size of the revenue generated by these industries carries, almost uniquely, the potential for whatever amounts are needed to redress their impacts on the

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279. *Id.* (citing J. RENNER, THE COASTAL ZONE: AN OVERVIEW OF ECONOMIC, RECREATIONAL AND DEMOGRAPHIC PATTERNS (1976)).

280. *Id.* (citing A. MUMPHREY, R. THAYER, F. WAGNER, J. BROOKS, C. FROMNERG, J. MILLER, J. WILDGER, A. YOUNG, G. CARLUCCI, M. LANDRY & T. WHALEN, OCS DEVELOPMENT IN COASTAL LOUISIANA: A SOCIAL-ECONOMIC IMPACT ASSESSMENT (1977)).

281. Treadway, *Treen, Edwards put transit problem in different laps*, Times-Picayune/States-Item, Mar. 27, 1983, § 1, at 9, col. 6.

282. This figure includes $9 billion in navigation and $6 billion in petroleum; to this figure must be added the value of almost 7 million cubic feet of natural gas. DRAFT ENVIRONMENTAL IMPACT STATEMENT, LOUISIANA RESOURCES PROGRAM, *supra* note 164, at 28.

283. For productions on the increase in shipping demand from the New Orleans Complex alone, see DEEP DRAFT ACCESS, *supra* note 9, at 28-37.

284. DRAFT ENVIRONMENTAL IMPACT STATEMENT, LOUISIANA COASTAL RESOURCES PROGRAM, *supra* note 164, at 28.

285. *Id.*

coastal zone. Lastly, if redress of this problem is going to be made a matter of national and state policy, whatever share is going to be contributed by the oil and gas industry will have to be set in motion at an early date, lest the coast be left in the position of other areas of the country where the extractive operations have come, taken, and gone away.[286]

Against this background is raised the question of whether the remedy is worth the effort. The answer depends largely on how one perceives what Louisiana stands to lose, and is already losing, at a rate of fifty square miles a year and growing.

B. On the Other Hand

The following is a summary, inadequate at best and glaring in its omission of those intangible values which attach to an ecosystem as unique, historic, and, to some eyes, as beautiful as the Louisiana coastal plain. Some resource values of the coastal zone are obvious, particularly those of its "products" in commercial fisheries and wildlife. Others of perhaps even greater value are taken for granted and easily overlooked.[287] By way of highlights only, then, these resources are at stake.

1. People

As of four years ago, more than 1.1 million people resided in the coastal zone, almost one-third of the population of Louisiana.[288] Furthermore, these coastal populations appear to be growing more rapidly than the rest of the state. Jefferson Parish grew by twenty-five percent between 1970 and 1977. St. Bernard, one of the parishes most threatened by coastal subsidence, grew twenty percent in that same period.

As lengendary as navigation in the story of Louisiana are

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286. "The scars left on the coastal landscape in south Louisiana by mineral extraction industries are comparable in many ways to the vast open pit mines of Appalachia. It is doubtful that they will every heal." Gagliano 1973, *supra* note 77, at 98.

287. For example, the oil and gas industry assessment of coastal losses, which are described essentially as impacts on quantities of fish. Edwards, Zehner & Moore, *supra* note 162, at 260. The industry, as most of Louisiana, has yet to appreciate the role of the coast in flood control, water supply, and other values, which, as shall be seen, equal or surpass those considerable values in commercial and sport fishing.

288. DRAFT ENVIRONMENTAL IMPACT STATEMENT, LOUISIANA COASTAL RESOURCES PROGRAM, *supra* note 164, at 29. The population data which follows is taken largely from this text.

Air Cushion Vehicles for the Transport of Drilling Rigs, Supplies, and Oil Field Exploration Operations in the Coastal Marshes of Louisiana.

by

Walter B. Sikora
Center for Wetland Resources
Louisiana State University
Baton Rouge, LA 70803

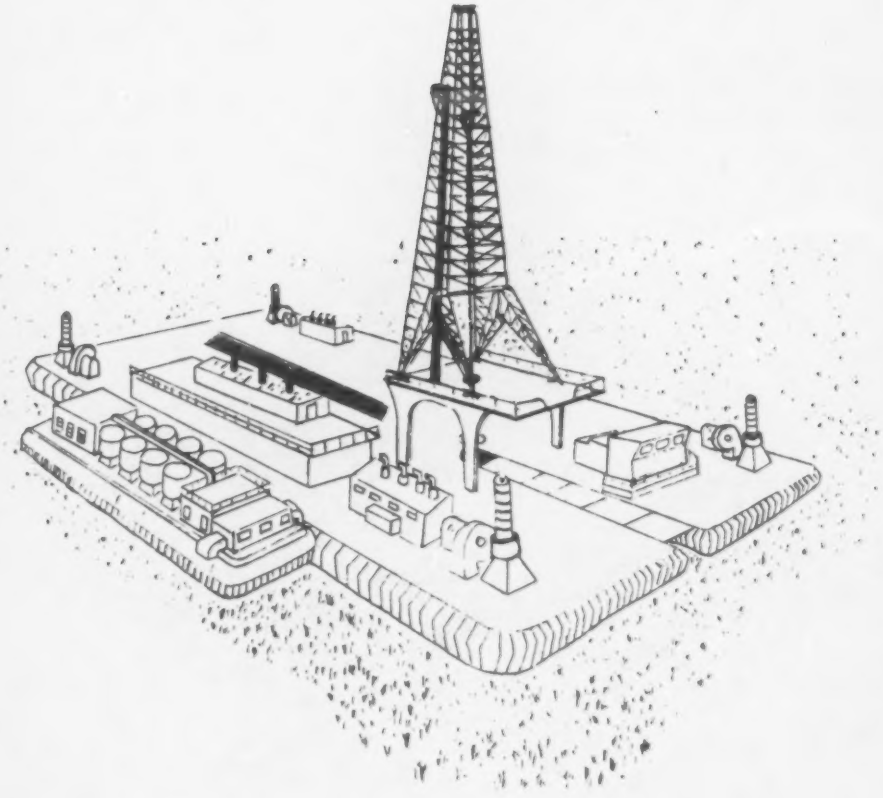

Figure I-1. Low altitude oblique photograph of the Golden Meadow Oil and Gas Field, in April 1982. For comparison and orientation with Figure I-2, arrow "P" indicates a pumping station in center of photograph. Arrows 1 through 6 indicate spoil bank impounded marsh areas which have decayed and turned into open water. (Photo by E. Swenson)

Figure I-2. High altitude, vertical photograph in November 1983 of same area as Figure I-1. Corresponding arrows indicate pumping station and decayed, impounded marsh areas. Bayou Lafourche appears as a dark diagonal stripe in extreme upper left corner of photo, and the eastern shore of Catfish Lake appears midway on the lower margin. (Photo from Nat. High Alt. Photog. Frame #162, NHAP81000773)

Figure I-3. Low altitude oblique photograph of a severely canalled marsh adjacent to Grand Bayou Blue which appears in foreground at bottom, traversing photograph from left to right. This area, in the central portion of the Lake Felicity 15' quadrangle map, was developed in the 1960s. Arrows point to stressed marsh, partially impounded by spoil banks, which is in the process of breaking up and decaying, or has already disappeared. In the original color slide taken in May 1983, the stressed marsh areas are brown and contrast with the bright green of the unstressed marsh. (Photo by author)

Figure I-4. Low altitude oblique photograph taken in Oct. 1983, looking east, of the Lafitte Oil and Gas Field which appears in the lower right quadrant of the "Barataria" 15' quadrangle map, and on the "Three Bayou Bay" 7.5' quadrangle map. Left center is the Texaco pumping and storage area. The large waterway running diagonally in photo is the Barataria Bay Waterway. Discoloration on water surface in foreground is oil sheen. The central area of this field, just out of view, beyond the upper left corner, is shown in the next two figures, I-5 and I-6. (Photo by author)

The CHAIRMAN. Thank you very much, Dr. Houck. Next we have Jim Gosselink who is with the LSU Center for Wetlands Resources.

STATEMENT OF DR. JAMES G. GOSSELINK, PROFESSOR OF MARINE SCIENCES, LSU CENTER FOR WETLAND RESOURCES

Dr. GOSSELINK. Thank you, Senator Johnston. I appreciate the opportunity to talk at this hearing. I've been on the LSU faculty for 25 years. Most of that time as an Ecologist in the Center for Wetland Resources. My testimony today reflects my experiences in that position and it follows also closely the recommendations of the National Wetlands Policy Forum of which I was a member.

I think I would like to depart from the tone of most of the comments we've had and talk a little bit about one specific part of your amendments, proposed amendments. That is the planning portion of it which I feel needs some clarification.

The Mississippi River at its deltaic coastal basin are interrelated ecosystems that function ecologically as a unit. They can't be managed effectively as small isolated parts, nor managed to promote a single product of process if the River is diverted for sediment enhancement of the wetlands. It also means water diversions. It means that there are very specific spacial consequences of that diversion in which some areas will receive more sediments and others will receive less sediments and less water. There are implications for water quality and there are implications for the natural renewable resource, fisheries. Especially perhaps for the oyster industry that are inevitably intertwined with any kinds of proposals or projects to divert the Mississippi River or part of it.

Because the system is a single interrelated whole, it suggests that any kind of effective program to manage the coast must focus on at least three levels of planning and project implementation. In general, I don't see any real explicit recognition of this kind of hierarchy.

The whole Mississippi River Alluvial Flood Plane is kind of the top of the hierarchy, and Paul Templet's list of suggested projects fall in this scale. They deal with the massive movement of the Mississippi River and its effect on the coast. Below that though you have individual drainage bases such as the Barataria Estuary, the Chenier plane coast which are hydrologically distinct and have different problems, although they are all driven, in one way or another, by the Mississippi River.

This suggests that we need another level of planning that focuses at that level or perhaps a million hectares.

The CHAIRMAN. I am not sure I understand the point about the hierarchy of planning.

Dr. GOSSELINK. I guess an example is that suppose that one or more of the large freshwater and sediment diversion projects is put in place which effects pretty much the whole—all the distributaries in the Mississippi River. Especially if some of the old distributaries are opened up. At the local level, are we going to permit continued development of marsh management plans which essentially isolate sections of the marsh? It seems to me that this is directly antithetical in that it prevents the new sediment supply from these diversions.

The CHAIRMAN. Well the legislation neither suggests nor requires that you do something in one part of the marsh that is harmful to the other part of the marsh. We do require the setting aside of projects, but projects may involve the activities. A detail description of the proposed projects, including justification for including such project on the list, the proposed activities to be carried out pursuant to the projects. In other words, it contemplates that it could be a construction project, the building of a freshwater diversion pump or whatever, the building of weirs. It could involve the planting of plants or grasses, but there is nothing there that would suggest that you have to seal off one part of the marsh and treat it separately as a project to the detriment of the others. To the contrary, that would be inconsistent with the whole idea of the legislation. The legislation is to enhance, preserve, and protect the marsh and not to protect one part of it to the detriment of another part.

Dr. GOSSELINK. I entirely agree. I guess I didn't state very clearly the point I was trying to make. At each level the management of the system has to reinforce the other levels. We are currently permitting what I call the "vulcanization" of the marshes before small marsh management projects, and it seems to me that would be in direct conflict with the aims of a larger diversion. So all I'm suggesting is that there needs to be clear priorities set and that these need to be coordinated at all levels. That's a very difficult thing to do.

The CHAIRMAN. That is why we provide for the Secretary of the Interior to coordinate with the Corps of Engineers, EPA, Commerce, the State. All would be involved in the description, the defining, the planning of the projects.

Dr. GOSSELINK. I guess my remarks are directed more to what is not there than what is present. I have no problems with what you've stated in the act. I think our experience shows that in fact most projects are planned on an ad hoc basis without a look at the influence on the total resource, and in part this is because we don't look at the system as a whole unit. There are ways emerging and new kinds of ecological approaches that allow one to treat whole units effectively and to derive goals and explicit plans for these units and that kind of approach needs to be implemented in this process.

I think that's really the main message I wanted to make. Rather than repeat what's in my testimony here, I'll let it stand at that. Thank you.

[The prepared statement of Dr. Gosselink follows:]

TESTIMONY TO COMMITTEE ON ENERGY AND NATURAL RESOURCES OF THE U.S. SENATE, at Baton Rouge, LA, August 31, 1989.

by James G. Gosselink
Professor of Marine Sciences
Louisiana State University
Baton Rouge, LA 70803

By way of introduction, let me state that I have been on the LSU faculty for 25 years, most of that time in the Center for Wetland Resources (CWR). CWR faculty have led the coastal research that identified the current wetland loss problem in Louisiana since Dr. Gagliano, then an LSU faculty member, first quantified wetland loss rates about 20 years ago; and have been an important force in identifying the causes and recommending solutions. Your own research organization, the Congressional Office of Technology Assessment, turned to the CWR for information when it produced its authoritative 1984 report "Wetlands: Their Use and Regulation". CWR personnel produced one of the four regional reports that went into that document, and Dr. William Patrick of the CWR was chairman of OTA's Wetland Advisory Panel.

More recently I was privileged to be a member of the National Wetland Policy Forum, sponsored by EPA and conducted by The Conservation Foundation. My testimony today reflects my experiences in the CWR, and follows closely the recommendations of the National Wetlands Policy Forum (see "Protecting America's Wetlands: an Action Agenda", The Conservation Foundation, Washington, D.C.), although I speak as a private citizen, not as an official representative of either LSU or the Forum.

This hearing addresses two questions. (1) What specific projects should be undertaken to preserve, restore and enhance Louisiana's coastal wetlands?, and (2) How can we pay for these projects? I will address the first question primarily, followed by a few comments on the second.

Projects to Restore and Enhance Coastal Louisiana On this subject I wish to make three main points, which are interrelated.

(1) Louisiana's coastal wetland loss is a national issue, and one that requires federal assistance in its solution.

a) The Mississippi River drains more than one half of the United State onto the Louisiana coast; our problems are due, in part to modifications of the river and upper watershed over which Louisiana has no control.

b) Many major changes in the coastal ecosystem, including changes that have accelerated the rate of coastal wetland loss, occurred as a result of large federal projects with national benefits(GIWW, Mississippi River flood control and navigation projects).

c) The renewable and non-renewable natural resources of the Louisiana coast (oil, gas, fisheries) are national, not local, resources, that have been and continue to be exploited for the national good.

(2) The Mississippi River and its deltaic coastal basins are interrelated ecosystems that function ecologically as a unit. They can not be effectively managed as small isolated parts, nor managed to promote a single product or process (navigation, ducks, shrimp). This observation suggests that the solutions to our problems must address large systems first, although local projects are also important in the context of plans for the whole ecological system. Generally natural hydrologic boundaries describe the limits of these systems.

(3) This last point suggests that an effective program to manage the Louisiana coast must focus on three levels of planning and project implementation: (a) the whole Mississippi River Alluvial Floodplain, perhaps as far north as Memphis; (b) individual hydrologic units of that system, such as the Barataria Bay estuary (these units are hydrologically distinct, with the Mississippi River the main natural external force affecting them); and (c) local projects, such as those for which one now typically require

a Section 404 permit. At each of these levels it is imperative to establish clear goals for the future, and to develop spatially explicit plans for their implementation. At each level, these goals and plans should reinforce and support those of the next higher level in the heirarchy. I cannot stress enough the necessity for this kind of approach.

The proposed Amendment to the Outer Continental Shelf Act is not, in my opinion, nearly strong enough on this point. And this hearing, by calling for specific projects, puts the cart before the horse. Specific projects should be implemented only in the context of comprehensive goals that deal with the entire resource in question.

(a) Currently planning is ad hoc with little regard for the impact of a specific project on the entire functional ecosystem. This is true of Corps of Engineers projects, projects initiated by local jurisdictions (e.g., new ports, flood protection levees), oil and gas activities (e.g., access canals), and local permits for "marsh management" which are Balkanizing our coastal estuaries. These ad hoc projects: (i) ignore the interrelations of parts of the ecosystem, and the influence of an action in one place on the ecosystem elsewhere; (ii) ignore the cumulative effects of many small actions (e.g., the progressive compartmentalization of coastal estuaries by private "marsh management" projects); (iii) ignore impacts to large scale processes that drive the coastal ecosystems (e.g., the volume, timing, and pathways of fresh water and sediment flows); (iv) enhance specific processes and products without regard to (and usually at the expense of) project effects on other processes.

(b) The goal-setting and planning exercise allows the public, including all interested parties, to have a voice in the future of the resource, and to reach a consensus before an irrevocable commitment of resources to specific actions.

(c) The planning process allows for initiation of comprehensive goals and plans for an optimal mix of activities that both protects and enhances the

environment, while allowing for reasonable and responsible development.

(d) Goals and plans identify priorities for action, that is, a logical temporal sequence for achieving the desired goals.

(e) Basin-level goals and plans provide a framework within which individual local projects can be judged; that is, whether or not local plans are consistent with plans for the larger system, and whether they are sound from a basin scale viewpoint.

(f) Basin-level goal-setting, and the planning process identify research and engineering needed to solve planning problems, for example what gaps in our understanding we need to fill in order to achieve a specific goal, or what new engineering approaches need development and testing to fulfill a recognized planning need.

Planning is traditionally a cumbersome and difficult enterprise. Nevertheless without this kind of planning I have little hope for any effective restoration of the Louisiana coast. In the context of my remarks planning requires a focus on landscape scales and processes, an ability to focus a diverse group of individuals on a goal-setting problem and to reach consensus, and a knowledge of available effective engineering, regulatory, and non-regulatory techniques and tools to implement goals. This requires an unusual blend of expertise, including mesoscale systems ecologists and landscape planners, group dynamics experts, and individuals thoroughly familiar with environmental regulations and non-regulatory "tools" that might be used to achieve specific goals (such as monetary incentives, tax incentives, private funding sources such as the Nature Conservancy, etc.). Federal agencies do not, at present, have this kind of expertise. Indeed the conceptual and technical background for this approach is still in the process of development by academic centers. (I have with me a limited number of copies of two recent reports that illustrate this planning approach to large systems, and that amplify some of my

remarks. This approach has been tested successfully and is currently being tried on the Pearl River basin.)

Funding. Since the loss of Louisiana coastal wetlands is a national problem, and since oil and gas production both offshore and onshore have contributed to the problem, I have no hesitation in endorsing the recommendation to use a federal tax on offshore gas production to finance restoration. It seems entirely appropriate. In addition, the Louisiana legislature recently sent to the voters a constitutional amendment to set aside state funds from oil and gas revenues for coastal restoration. One additional source of funds I would like to suggest is appropriations to the U.S. Army Corps of Engineers (COE). Large appropriations are still being made for projects authorized as long as 40 years ago, which with our present environmental insights, can no longer be justified. It seems appropriate that the mission of the COE should be changed to make environmental protection and enhancement co-equal with flood control and navigation. Along with this change there could be a significant shift in funds from navigation and flood control projects to environmental restoration. An example is the $ 3.5 million that had been proposed in the COE appropriation, for Ouachita River modification for improved navigation through public lands in Arkansas. This money could be much better spent on restoration projects, or to initiate comprehensive planning for the future of the Mississippi River Alluvial Floodplain.

I appreciate this opportunity to speak to members of the Senate Committee on Energy and Natural Resources. Thank you.

The CHAIRMAN. Thank you very much, Dr. Gosselink. Finally, we have Mr. Jim Porter who is President of Mid-Continent Oil and Gas. Jim, glad to have you.

STATEMENT OF JIM B. PORTER, PRESIDENT, MID-CONTINENT OIL AND GAS ASSOCIATION

Mr. PORTER. Thank you. I appreciate the opportunity to be here with you today. I am Jim Porter and I represent the Louisiana Mid-Continent Oil and Gas Association which represents individuals and companies that explore, produce, refine and market about 90 percent of the gas and oil that comes from the State of Louisiana.

I guess really to just kick it off is that we, along with everybody else who is here and who spoke today, feel that this is a national problem. Senator, as you stated in your opening remarks, we recognize that it's a national problem and is of such magnitude that it will require the Federal government to come in and help solve this problem, if not entirely solve it. I was not going to talk a lot today about solutions. You've heard that from most everybody that has been here. However, in hearing the testimony, I would add two comments which will add a little bit to what Dr. Houck and Dr. Gosselink have said.

We have talked about the Caernarvon and the Bonnet Carre and the Davis Pond. All of those are freshwater diversions and we can't lose sight of that. All that does is provide freshwater into our marsh to replenish it. Those are not the type programs that will provide sediment into those areas. Freshwater diversion is one thing, but when you talk about moving sediment, it is much more difficult and a much more expensive issue. Dr. Gosselink indicated spacial problems. It's easy to put sediment into a small area, but you cannot get it in a very broad area.

The other issue I think that Dr. Gosselink was trying to make is with regard to wetland management. If you look at the coast of Louisiana, there are vast areas under private ownership there. Some of these things are bigger than what government can solve and I think we have got to look at what we can do with regard to letting those landowners, and maybe giving them incentives for them to manage that. There are disputes among technical groups now about what you should do with regard to managing that. You heard Dr. Gosselink say about you're trying to isolate this from the area, and therefore, it would not be able to benefit should there be sediment moved into those areas. Those are disputes, those are disagreements that are being discussed now, but it's an issue I think that's got to be certainly looked at.

With that I will not talk about any more solutions. I guess I'm the only person here today representing a group that their ox is being gored. Everybody else has said—you know—we're all in favor of your program, and you indicated one of the key components of your amendment is of course, providing the additional revenue to pay for this. Our position is one that we feel like this is a national problem and that the revenues should be from a broad base and should come from the general fund of the Federal government. We say that not just on the fact, but we do feel like it's a national

problem. That comes from the standpoint if you zero in on Louisiana and OCS, there is a mature providence out there. We have got to maintain ourselves in a competitive position. This would be a tax that is added onto that and we cannot just simply pass that on to other areas in the country because we are competing with gas from this area from that of Oklahoma and other areas which would not have this tax. As simply as I can put, is just that basis as to why we would think it should be a broad base tax.

Now with regard to using revenues that the Federal government gets from the OCS, I think that would be a way of spreading that out. I think over the past years its been $54 billion that have gone into the Federal Treasury and that would be a possible way to do it.

The issue that is there is certainly a complex problem. There's a multitude of causes that have caused this problem and it's man's activities. Contrary to what Dr. Houck said, I feel like most of the studies that I have seen, it points to the fact that the levee and the Mississippi River is the major cause of the problem. The MMS has done some studies and they have indicated that if you look at OCS production that about five percent of the damage is due to OCS production and that's the Turner study that he was referring to.

If you look at indirect causes maybe that goes to eight to 17 percent of where there's indirect. So I do not think that you can simply state that oil and gas is the major cause of this problem. I think it's being recognized more and more now that that's not the case.

So in general, we are in support, Senator, of your efforts to make this recognized as a national issue, to bring the money that is necessary. There is no doubt that it is a serious problem. It's a problem that needs to be solved and so we would just like for you to look to another source for your funds.

[The prepared statement of Mr. Porter follows:]

TESTIMONY OF

B. JIM PORTER
PRESIDENT

LOUISIANA DIVISION
MID-CONTINENT OIL AND GAS ASSOCIATION

BEFORE THE

SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES

SEPTEMBER 1, 1989

BATON ROUGE, LOUISIANA

GOOD MORNING. MY NAME IS B. JIM PORTER AND I AM PRESIDENT OF THE LOUISIANA DIVISION OF MID-CONTINENT OIL & GAS ASSOCIATION. LOUISIANA MID-CONTINENT IS A TRADE ASSOCIATION REPRESENTING INDIVIDUALS AND COMPANIES WHO PRODUCE, TRANSPORT, REFINE AND MARKET OVER 90% OF THE OIL AND NATURAL GAS PRODUCED IN OR TRANSPORTED THROUGH LOUISIANA. THE ASSOCIATION HAS REPRESENTED THE LOUISIANA OIL AND GAS INDUSTRY SINCE 1919. WE APPRECIATE VERY MUCH THE INVITATION TO JOIN YOU TODAY.

LOUISIANA FACES MANY PROBLEMS, BUT FEW ARE AS SERIOUS AS THE STATE'S COASTAL EROSION PROBLEM. HOPEFULLY, WE IN LOUISIANA CAN WORK TOGETHER WITH YOU TO DEVELOP REASONABLE AND APPROPRIATE SOLUTIONS TO THIS TREMENDOUS PROBLEM.

I WAS ENCOURAGED, SENATOR JOHNSTON, BY YOUR LETTER OF INVITATION. IN IT YOU STRESSED THAT TESTIMONY TODAY FOCUS ON **SOLUTIONS** TO OUR COASTAL EROSION PROBLEM. ENOUGH HAS BEEN SAID ABOUT THE MAGNITUDE OF THE PROBLEM. WE IN THIS ROOM UNDERSTAND THE MAGNITUDE OF THE PROBLEM. IT IS TIME THAT WE BEGIN TO DEFINE AND UNDERTAKE SOLUTIONS.

YOU ASKED THAT WE LIMIT OUR TESTIMONY TO (1.) RECOMMENDATIONS FOR SPECIFIC SOLUTIONS TO LOUISIANA'S COASTAL LAND LOSS PROBLEM, AND (2.) APPROPRIATE FUNDING MECHANISMS FOR THESE SOLUTIONS. I'M GOING TO LEAVE THE FIRST QUESTION TO THE ENGINEERS, GEOLOGISTS AND BIOLOGISTS WHO SPECIALIZE IN COASTAL PROCESSES. THEY'RE THE EXPERTS. I KNOW THAT THE

ANSWERS ARE COMPLEX AND VARIED. I KNOW THAT, TO A SIGNIFICANT DEGREE, THE ULTIMATE ANSWER MUST INVOLVE THE MISSISSIPPI RIVER. AND KNOWING THIS, I KNOW THE ANSWERS WILL BE EXPENSIVE AND CONTROVERSIAL. AS I SAID, I'LL LEAVE THIS ONE TO THE ENGINEERS, GEOLOGISTS AND BIOLOGISTS.

I WOULD LIKE TO SPEND MY TIME THIS MORNING DISCUSSING POTENTIAL FUNDING MECHANISMS. YOUR RECENTLY PROPOSED AMENDMENT NO. 229 IS ONE APPROACH. THERE ARE OTHERS.

FIRST, LET ME SAY THAT I BELIEVE IT IS ENTIRELY APPROPRIATE TO INVOLVE THE FEDERAL GOVERNMENT IN ADDRESSING LOUISIANA'S COASTAL EROSION PROBLEM. IT IS GENERALLY ACCEPTED THAT, IF WE ARE TO SIGNIFICANTLY RETARD LOUISIANA'S COASTAL LAND LOSS, BILLIONS OF DOLLARS WILL BE NEEDED TO FUND THE EFFORT. LOUISIANA CANNOT SOLVE THE PROBLEM ALONE; NOR SHOULD IT.

LOUISIANA'S COASTAL WETLANDS ARE OF NATIONAL SIGNIFICANCE. THEY CONTRIBUTE TO SOME 25% OF THE NATION'S FISHERIES HARVEST. THEY PROVIDE PRIME HABITAT FOR MIGRATORY WATERFOWL, SONG BIRDS, FURBEARING ANIMALS, DEER AND MANY OTHER GAME AND COMMERCIAL SPECIES. THEY REPRESENT ABOUT 40% OF THE COASTAL WETLANDS OF THE CONTINENTAL UNITED STATES.

IT IS OBVIOUSLY IN THE NATIONAL INTEREST TO CONSERVE THESE WETLANDS AND TO RETARD THE CONTINUED LOSS OF THESE WILDLIFE AND FISHERIES VALUES. BOTH YOUR AMENDMENT AND SENATE BILL 630 BY SENATOR BREAUX APPROPRIATELY RECOGNIZE THE

NEED TO BRING THE FEDERAL GOVERNMENT INTO THIS PROCESS.

THE MORE DIFFICULT QUESTION, GIVEN THE FISCAL SITUATION OF BOTH THE FEDERAL GOVERNMENT AND THE STATE OF LOUISIANA, IS WHERE TO FIND THE NECESSARY FUNDS. WE STRONGLY BELIEVE THAT THE MONEY SHOULD COME FROM A BROAD-BASED GENERAL REVENUE SOURCE.

WHEN ONE REVIEWS THE SCIENTIFIC STUDIES ON LOUISIANA'S LAND LOSS PROBLEM, IT BECOMES QUICKLY EVIDENT THAT A MULTITUDE OF FACTORS ARE RESPONSIBLE FOR THE LOSS. SOME SCIENTISTS BELIEVE NATURAL CAUSES ARE PRIMARILY RESPONSIBLE. SOME BELIEVE IT IS MAN. ALL ADMIT IT IS A COMBINATION OF BOTH. THERE IS NO **SINGLE** CAUSE.

THIS SUGGESTS THAT WE SHOULD FUND ANY WETLANDS RESTORATION AND PROTECTION EFFORT VERY BROADLY. RESTORATION OF NATURALLY INDUCED WETLAND LOSS SHOULD BE FUNDED FROM A GENERAL REVENUE SOURCE, AS SHOULD LOSSES RESULTING FROM FLOOD CONTROL LEVEES BUILT ALONG THE LENGTH OF THE MISSISSIPPI RIVER AND THROUGHOUT LOUISIANA, AND LOSSES FROM URBANIZATION, AGRICULTURAL EXPANSION, ROAD AND DRAINAGE CONSTRUCTION, CONSTRUCTION OF NAVIGATIONAL CHANNELS, AND A MULTITUDE OF OTHER MAN-MADE STRUCTURES. FUNDING FOR WETLANDS RESTORATION SHOULD BE BROAD-BASED.

FOR THESE REASONS IT IS INAPPROPRIATE TO SINGLE OUT THE OFFSHORE OIL AND GAS INDUSTRY AS A FUNDING SOURCE. A RECENT MINERALS MANAGEMENT SERVICE STUDY CONDUCTED BY SCIENTISTS AT

LSU CONCLUDED THAT NO MORE THAT 4 TO 5% OF LOUISIANA'S WETLANDS LOSSES COULD BE DIRECTLY ATTRIBUTED TO OCS ACTIVITIES. EVEN IF ONE CONSIDERED ESTIMATED INDIRECT IMPACTS, THE TOTAL OCS IMPACTS WERE CONCLUDED TO BE NO MORE THAN 8 - 17% OF LOUISIANA'S WETLAND LOSS.

EVEN THESE SMALL NUMBERS MUST BE PUT INTO PERSPECTIVE. IT IS IMPORTANT TO NOTE THAT PRIVATE LANDOWNERS, WHO OWN SOME 75% OF LOUISIANA'S COASTAL WETLANDS, AND THE STATE ARE DIRECTLY COMPENSATED FOR MANY OF THESE IMPACTS IN RIGHTS-OF-WAY AND SIMILAR AGREEMENTS. ALSO, OCS ACTIVITY HAS PRODUCED SOME $54 BILLION FOR THE U.S. TREASURY AND THOUSANDS OF JOBS FOR LOUISIANA CITIZENS. BOTH THE FEDERAL GOVERNMENT AND THE STATE OF LOUISIANA HAVE BENEFITED GREATLY FROM THIS ACTIVITY.

IT IS ALSO IMPORTANT TO NOTE THAT BECAUSE OF IMPROVED TECHNOLOGY THERE IS LITTLE WETLAND IMPACT ASSOCIATED WITH **CURRENT** OCS ACTIVITIES. FOR EXAMPLE, PIPELINE CONSTRUCTION TODAY HAS MINIMAL ENVIRONMENTAL IMPACT.

FINALLY, WE MUST REALIZE THAT THE GULF OF MEXICO IS A MATURE PROVINCE. TO THE EXTENT THAT ADDITIONAL COSTS CANNOT BE PASSED ON, THEY WILL ONLY ADD AN ADDITIONAL BURDEN TO THE ECONOMICS OF PRODUCING OIL AND GAS IN THE GULF. THESE COSTS ARE LIKELY TO RESULT IN THE PREMATURE ABANDONMENT OF SOME PROPERTIES AND DECISIONS TO DELAY OR ABANDON FUTURE DEVELOPMENT OF OTHERS.

IN SUMMARY, WHILE THERE HAVE BEEN SOME IMPACTS

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ASSOCIATED WITH OFFSHORE OIL AND GAS DEVELOPMENT. THESE IMPACTS HAVE TOO OFTEN BEEN HIGHLY OVERSTATED AND MUST BE CONSIDERED IN LIGHT OF THE MANY BENEFITS ASSOCIATED WITH THIS ACTIVITY. ALSO, SIGNIFICANT IMPROVEMENTS IN TECHNOLOGY HAVE GREATLY REDUCED THE ENVIRONMENTAL IMPACTS ASSOCIATED WITH OCS DEVELOPMENT. FINALLY, WE MUST RECOGNIZE THAT THE GULF OF MEXICO IS A MATURE PROVINCE AND THAT ADDED COSTS CAN SIGNIFICANTLY AFFECT THE ECONOMICS OF EXISTING PRODUCTION AND THREATEN FUTURE DEVELOPMENT.

ALL OF THESE FACTORS ARE IMPORTANT IN CONSIDERING THE MOST APPROPRIATE MEANS OF FINANCING COASTAL WETLANDS RESTORATION AND PROTECTION. WE BELIEVE THEY POINT OUT THE NEED FOR A BROAD-BASED GENERAL SOURCE OF REVENUE.

IF AN ADDITIONAL TAX IS PLACED ON OCS PRODUCTION THE BURDEN OF THAT TAX WILL FALL ON THE PEOPLE OF LOUISIANA. BECAUSE IMPORT AND NON-OCS OIL AND GAS PRODUCTION ARE NOT SUBJECT TO THE TAX, IT WILL NOT BE POSSIBLE TO PASS THE TAX ON TO CUSTOMERS OUTSIDE THE STATE. THE BURDEN OF THE TAX WILL THEREFORE FALL ON LOUISIANA PRODUCERS AND CAN ONLY ADVERSELY AFFECT CURRENT AND FUTURE OCS ACTIVITY.

IT IS ENTIRELY APPROPRIATE THAT THE ENTIRE NATION CONTRIBUTE TO ADDRESSING THIS PROBLEM. LOUISIANA'S COASTAL WETLAND LOSS IS INDEED A NATIONAL PROBLEM. THE MANY BENEFITS OF THE AREA ACCRUE TO EACH AND EVERY U.S. CITIZEN. FOR THAT REASON, IT IS ONLY FAIR THAT THE COST BE SHARED BY ALL

CITIZENS. THE PEOPLE OF LOUISIANA WILL NOT RECEIVE ALL OF THE BENEFITS OF RESTORING AND PROTECTING OUR COASTAL WETLANDS, NOR SHOULD WE BE FORCED TO BEAR THE COST.

WE ENCOURAGE YOU TO CONTINUE YOUR EFFORTS TO INVOLVE THE FEDERAL GOVERNMENT IN SAVING LOUISIANA'S COAST. IF WE ARE TO SOLVE THIS TREMENDOUS PROBLEM, WE MUST GET FEDERAL HELP. WE COMMEND YOU FOR YOUR EFFORTS IN THIS REGARD.

AGAIN, WE APPRECIATE VERY MUCH THIS OPPORTUNITY TO COMMENT AND LOOK FORWARD TO WORKING WITH YOU IN DEVELOPING APPROPRIATE SOLUTIONS.

The CHAIRMAN. Thank you very much, Mr. Porter. After 17 years on the Energy Committee and the Interior Committee, I don't think I have to prove my friendship and my fealty to the oil and gas industry. I am friends of the oil and gas industry because I think they are important to the nation. I know they are important to Louisiana. I don't want to do anything to hurt the oil and gas industry. I think you know that. It is not the intent of this legislation to do anything that would do that.

At the same time, wetlands, we all agree, every witness who has testified, says we need serious money. Now you say we should take it out of the general fund. There is no general fund. There is a general deficit and it is too big already. So when you talk about taking funding out of the general fund, that is, out of general revenues, what you have to do is take from some existing program. It is easy to say we will just take, we will cut all the programs across the board by one-tenth of one percent and everybody can take that. Except you can't cut everybody by one-tenth of one percent. You cannot cut social security by one-tenth of one percent. You cannot cut them at all and I am not going to suggest that; or Medicare—medicare is growing—or nutrition programs or all of the other programs. You simply cannot take it.

In order to produce the kind of revenue that we need, we need a new source which we can dedicate. Otherwise we are going to be five million here, two million there and it adds up to pretty good money. After all, we have spent $120 million on upland wetlands in Louisiana in the last few years, which is much more than any other state has done, which was I think a great accomplishment. But $120 million over the next five years will not even begin to—it will dent the problem, but it won't solve it. So we need a new source of revenue.

The tax of two cents for MCF on OCS gas. First of all that OCS gas—most of it is not consumed in Louisiana. What percent of it is consumed?

Mr. PORTER. A very small percent of it.

The CHAIRMAN. So most of it is consumed nationwide, so the tax, in effect, would be paid nationwide. That would be a tax of about one percent of the value of that gas and we hope—frankly, gas is priced way under its value right now—in the coming years we are going to find that the price of gas is going to increase. I expect that it will. I think you would agree with me that the surplus of the so-called "gas bubble" is about worked its way through.

Mr. PORTER. We certainly hope so, yes, we agree.

The CHAIRMAN. Most of my friends in the pipeline industry seem to think that if we have a cold winter this next winter, that problems of deliverability may begin to appear by this winter. With it, I think, an increase in the price of natural gas which would mean that the one percent tax which this would represent on OCS gas, would be an even smaller percentage.

I know you do not think that the gas industry on OCS should bear all this burden. I read that you think that the cause of our wetlands loss was not caused by the drilling for that gas, I understand that. But my question is, isn't it a fact that a one percent burden, while it is a burden, is not really going to stop drilling or production on the OCS? It is a small enough burden to not effect,

in a major way, the number of wells drilled, the amount of gas produced on the OCS?

Mr. PORTER. First of all, I would say that that would not stop drilling on the OCS because if you look at this country, that's about the only place you can go to drill now. The companies that are doing business in the United States are going to have to look to that. It just adds an additional burden on those producers. What I was talking about is we've got to take that gas and we've got to market it in competition with gas from other states and from Canada, and we've got to deliver it to the east coast. Now we might be able to pass some of that on and make that gas competitive here in Louisiana, but when you do that you may displace some of that here and would have to find another market source. Well I'm not going to say that one percent is going to cause a shutdown of that. It would not be. You've got to recognize, and as you very well do, that it is very competitive in the sale of natural gas. We have others to compete against.

The CHAIRMAN. Well, thank you for that answer. I think that's honest and I think it is correct. It is a burden, but not one that is really going to effect the amount of activity or the jobs in Louisiana. There was one guy who read the bill and said "My God, if you put that on Louisiana there will be massive unemployment, there will be thousands thrown out of work. There will be little operators, they will be roughnecks, there will be other people standing at lines with tin cups begging for bread." Literally, he said that, and that is obviously not true. One percent of value is not going to produce that result.

I wish we had another place to put it. Tax on cigarettes or something might be better, but I think this is an appropriate place. There is some connection. Whether it is, I think, three to four percent as stated in your statement or I think another study shows 12 or 13 percent connection. Who knows? It is not quantifiable what the percent of connection is of canals dug for both exploration on shore, which of course is not an OCS problem, but it is an oil and gas problem, or the pipeline canals which are an OCS problem. What part of the cause they were? There is some connection and certainly a clear connection in the public mind. So I thank you for that answer Mr. Porter.

Dr. Gosselink, you have heard the testimony here about a Mississippi River navigation channel to divert navigation out of the Mississippi River in order to let the River below New Orleans—more or less—run free, slow down, carry more silt, act in a more natural way. Do you have a view on that? Advisability on that?

Dr. GOSSELINK. I haven't really studied that idea very thoroughly, but it seems like a feasible type of approach.

The CHAIRMAN. With respect to the barrier islands, is pumping sand on those islands the technique of choice to preserve those islands?

Dr. GOSSELINK. Well frankly, the experiences I see along the coast suggest that it's a very short term stopgap. All the sediments that were pumped onto Grand Isle were moved back forcibly by the first storm that hit them, and again at a very rapid rate in the storms that we had this year.

The CHAIRMAN. Dr. Houck, what do you think of this navigation channel on the Mississippi River?

Dr. HOUCK. Senator, we're right on the bridge of the unthinkable which is where we are today. I think what we have to do is compare four regimes. You have to look at status quo, accept no diversion, look at the collapse in the loss of coastal Louisiana and what that would cost. That's one sheet of music.

Then on that same sheet, we have to superimpose three other looks. One is just what you've proposed. The navigation canal and then let the River go. The Corps is by mandate of the Secretary of the Army looking at that now, but it is my understanding that the conclusion they're drawing is that it's too expensive and it's environmentally unacceptable because it will fill in part of Breton Sound. I haven't seen the costs on it, but unless you separate the navigation function from the sediment building function, I don't think we can win the war.

The CHAIRMAN. Well does that do it? A navigation canal?

Dr. HOUCK. It doesn't do it all because there is building that has to take place elsewhere and there are diversions that have to take place north of the latitude even of the city of New Orleans in order to replenish and offset what's going on into Pontchartrain for example, Davis Pond, etc. But if you cut it off at the latitude of say Venice and let the River run free, you're springing 60,000 tons of sediment a day, and that's more than a lot of trucks could ever deliver. So sure.

Now what I am saying though is that we put the blinders on when we're looking at these things. I mean we're looking at "it" and saying, "it's too expensive." Well, darn it, that's not the question. Losing Louisiana is pretty expensive, too. So if we have to compare the current loss scenario to this scenario, to another scenario which are Paul Templet's 20 plus diversions, what that would cost, which is sort of a mini way of doing this maxi project.

The CHAIRMAN. What do you think of his 20 plus diversions?

Dr. HOUCK. I think they're extremely expensive ways of getting at what then becomes to look much more feasible; which is letting the whole sucker go below, say Venice, and then a few diversions north of Venice. But that's the comparison that needs to be made in terms of effectiveness and cost.

Then you plug in the fourth, which is the Atchafalaya option. Now truly unthinkable, but the real cost in the Atchafalaya option which is 50 percent or more down the Atchafalaya is not the navigation. The silts will still float. The Mississippi will still be wet, it will just be more saline. The real difficulty with diverting the Mississippi down the Atchafalaya and the real cost is alternate water sources, which wouldn't do the city of New Orleans any harm anyway. To go, to say, an underground aquifer instead of Mississippi River water.

The CHAIRMAN. Now, wouldn't the Mississippi River—if you diverted the Mississippi into the Atchafalaya, wouldn't the Mississippi silt up?

Dr. HOUCK. No, you'd have an estuary because more sediment would go down the Atchafalaya just as more water would go down the Atchafalaya.

Ray Casmines study of that, "What If Old River Fails?"—which precipitated your hearings, I think eight, nine years ago—concluded that the Mississippi remains open as an arm of the sea as a Lake Pontchartrain, if you will. And that the real cost in the option is the freshwater supply cost which is both industrial and municipal and significant. But all the costs are significant and what I am saying is we today can't pick the option. But unless you put all four of these—the current loss scenario which is unacceptable, 20 diversions, a mega diversion south of New Orleans, or the Atchafalaya; until you put them on a sheet and compare them, we're kicking away at a problem without understanding all of it.

The CHAIRMAN. Colonel Gorski, I wonder if you would mind coming up to respond to this unthinkable situation. The question is, what happens if we let the Atchafalaya capture the Mississippi River? What happens to navigation between Baton Rouge and south?

Colonel GORSKI. Mr. Chairman, I certainly would not want to contradict as eloquent and professionally qualified a spokesman as Dr. Houck. He certainly speaks with great authority and as I've said, we will look at what the impacts would be. Everything that I have studied so far supports what Dr. Houck says. The problems are not only navigation, but they are salinity intrusion as well.

The CHAIRMAN. I have always understood that if you took most of the flow out of the Mississippi River, that problems of silting up would be immense. Is that not correct?

Colonel GORSKI. Again, if you slow the water down in the Mississippi and send less water down the River, you will have less sediment transport because the River does not have the hydraulic capacity to carry the sediment. If you'd send that water down the Atchafalaya and the sediment along with it, obviously you will have more delta building in the Atchafalaya. If you have what will amount to a slack water channel in the lower Mississippi River, there will still be some sedimentation. The flow in the lower River at that point would be largely tidal. It would move in from the Gulf and out from the Gulf. It would not be generally positive outflow like a river, but you'd still have sedimentation. You'd still have a dredging problem.

The CHAIRMAN. Would it be a bigger dredging problem?

Colonel GORSKI. I can't say.

The CHAIRMAN. Dr. Houck?

Dr. HOUCK. Well, I am delighted that today you've arrived at that inquiry because that's the inquiry that hangs over us. That's the mega inquiry from which all the planning should then and the project should take place. I'm delighted that this hearing, if nothing else, has generated that inquiry, because that's what needs to be asked. I'm a little saddened that with all we've known for 15 years, that we were going to need to do to save coastal Louisiana, we're only now daring to ask that question; because it really does need to be asked. If we send it down the Atchafalaya, then what in terms of the dredging? I think the answer is going to be not a heck of a lot more than if we went to 55 foot. Not a heck of a lot more than if we mega diverted or 20 diversion diverted above New Orleans. You're going to have very similar effects with regard to those closed at Head of Passes.

The CHAIRMAN. Now what do we have to do to the Atchafalaya to make it contain that much water? Do we have to dredge it to keep Morgan City from floating away? [Laughter.]

Colonel GORSKI. Again, I would not be prepared to tell you exactly what the impacts would be. I will tell you that the Atchafalaya now, because of the sediment load that the River carries, does experience considerable amount of siltation. I was out in the swamps of the Atchafalaya Basin just a couple of months ago and back into the back waters and the old Cajun that was taking me around in his little boat was showing me what at one time had been open bayou is now silted up and filled in because of the processes that are going on. If we increase the sediment load in the Basin, of course we're going to change the balance in the Basin and of course some of that siltation will take place in the Basin itself. It will not all be carried down to the coastal region and occur in the coastal region.

The CHAIRMAN. Why haven't we studied this real question, or have we studied it? It is the seminal question according to Dr. Houck. Should we study this and can we know—is it possible to know from studies and from the Vicksburg model and others, how much siltation you get in the Mississippi River? What the effects of navigation are by diverting the River without actually doing it? Dr. Houck?

Dr. HOUCK. These are unfair questions, in a way, to ask of the Colonel because he's so new to the district, but he does have contained in other studies, including the Atchafalaya study, examination of the consequences of different rates of flow through Old River. Those studies were unfortunately done before you built the new Old River structure which gives you a new method of containing the River. It also did not get to the level of detail that the Senator would and that we need to, which is, what are the effects on maintenance dredging of the main Mississippi? Again, you can get there quickly if you decide to do it. You have the knowledgeable people and the resources to get to that kind of an answer quickly and then put it on a comparative basis to 20 diversions or a mega diversion. The mega diversion you already have on your study. And you can come up with four--you can get four scenarios for the first time on the same sheet, in terms of mega cost, maintenance, navigation, land building. Those are the three things we need to know.

The CHAIRMAN. Dr. Houck, you were talking about also diversion of people. What do you mean by that?

Dr. HOUCK. I mean, for example, that if you're to implement, as I think you should, Dr. Templet's suggestion that we redistributary the Mississippi to let the natural distributaries act as diversions, such as out through Bayou Lafourche. One look at Bayou Lafourche will show you that there's a lot of human habitation right along, cheek by jowl to the bayou. They'll have to be set back in floodway like fashion. That's going to be the cost.

The CHAIRMAN. You mean building levees?

Dr. HOUCK. Well sir, I mean if we're to throw the Mississippi back out by Bayou Lafourche, we're going to be putting greater quantities of water down through where people now live. Those people are going to have to be set back from where that water comes.

The CHAIRMAN. You mean the 9th ward and Bayou Lafourche would have to be moved? [Laughter.]

Dr. HOUCK. I don't have the level of detail to make that prediction.

The CHAIRMAN. May I have it on record as being opposed to that suggestion? [Laughter.]

Dr. HOUCK. I remember Bayou Benoit on the Atchafalaya.

The CHAIRMAN. Is there another bayou that is not populated?

Dr. HOUCK. We'll find you one. But I do think we're going to need to think about people.

The CHAIRMAN. A couple of people, but there are a lot of people in Bayou Lafourche. I hope most of them vote for me too.

Dr. KEMP. Might I make one?

The CHAIRMAN. Yes, would you?

Dr. KEMP. We tend to think entirely in terms of open channels, but there are also the possibility of using pipelines. Pipelines that may be used today for other things could be converted to a use for wetlands restoration. We have undoubtedly the most densely developed pipeline networks in the coastal zone of Louisiana that exist anywhere in the world. There is an infra structure there which has had a cost, (it's been put in at a cost to the wetlands) but there is a potential there for also using that infra structure to move sediment and water around to areas that you can't get at with open channels, and it's a lot easier in some cases to move sediment and water through the pipelines and you can move a lot of it, and you have more control over it. That's something where industry can get very involved.

The CHAIRMAN. Are there pipelines that are no longer being needed which go from point of source to point of need?

Dr. KEMP. My understanding is that there is a large change taking place right now in this mature province that we have here. That has not really been looked into. One thing we have is a 60 (what, how much?) dredge material that we're using that could conceivably be shifted around through some sort of network if that could be developed. I'm just saying these are the kind of ideas that are just now emerging and that really haven't been thought of before. I would suspect that there are probably ten other ones like that, that haven't been mentioned today, because we're just now beginning to look seriously at these things.

The CHAIRMAN. I think that pretty well completes our testimony this morning. I want to thank you, Dr. Thomas, Dr. Kemp, Dr. Houck, Dr. Gosselink and Jim Porter, for your excellent testimony. We will keep the record open for two weeks if there is further testimony to be received, either by a panel member or by a non-panel member. We would be delighted to receive those. They can be sent either to my offices here in the State, we have an office here in Baton Rouge and one in New Orleans, also one in Shreveport, or to the Committee on Energy and Natural Resources at the Capitol in Washington, D.C.

Ladies and gentlemen, we all thank you very much. Your testimony has been excellent. We appreciate it.

[Whereupon, at 11:34 a.m., the hearing was adjourned.]

APPENDIX

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

OFFICIAL COMMITTEE FILE
PLEASE RETURN

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
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REPLY TO
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SENATE COMMITTEE ON
ENERGY AND NATURAL RESOURCES
RECEIVED
OCT 3 1988
WASHINGTON D.C. 20510

Honorable J. Bennett Johnston
Chairman
Committee on Energy and
Natural Resources
Washington, D.C. 20510-6150

Dear Mr. Chairman:

I am enclosing, for the record, answers to the questions posed at your hearing on coastal wetlands recently held in Baton Rouge, Louisiana.

Thank you for allowing me to testify on this most important issue.

Sincerely,

Richard V. Gorski
Colonel, U.S. Army
District Engineer

Enclosure

Senate Committee on Energy and Natural Resources
Field Hearing on the Wetlands Provision of Senate Amendment No. 229
Baton Rouge, Louisiana, August 31, 1989
Answers to Questions for the Record by Colonel Richard V. Gorski,
District Engineer, U. S. Army Engineer District, New Orleans, Louisiana

Q. Colonel, if leveeing and maintaining the Mississippi River is causing the problem, can we divert navigation out of the river?

A. We have just completed a reconnaissance report dealing with just that question. We have found that major diversions of Mississippi River flow and sediment are engineeringly feasible; however, the impacts of the large volumes of freshwater on the estuaries where such flows could be diverted make such diversion economically and socially undesirable.

The primary constraint to the diversion of Mississippi River flow and sediment for building land is the deep-draft navigation channel in the river and its Southwest Pass. Most of the river flows are needed to help hydraulically maintain the navigation channels. Major reductions in flows would significantly increase maintenance dredging and its cost. Two conceptual plans were considered for increasing the land-building capacity of the Mississippi River; (1) diverting flow and sediment from the river while maintaining deep-draft navigation in the present river channel, and (2) relocating the deep-draft navigation access channel between the river and the gulf, freeing the lower river for sediment diversion. The former was selected for further analysis as it had the highest potential for implementation.

A plan using navigation locks to separate the major river flow and the shipping traffic would cost approximately $1.5 billion. The most cost effective plan would accomplish the diversion by constructing an uncontrolled diversion of the main river flows to Breton Sound. Features of that plan include (1) a pilot channel between the Mississippi River and relatively deep water in Breton Sound, (2) extension of the intakes for the municipal waterworks at Bootheville, Louisiana, on the west side of the Mississippi River upstream of the diversion channel to mitigate increased saltwater intrusion, and (3) extensions of the jetty along the west side of the Mississippi River-Gulf Outlet to prevent excessive sedimentation in the navigation channel. The diversion of flow and sediment from the river at Bohemia, Louisiana, would result in a significant increase in maintenance dredging in the Mississippi River.

Such diversions would result in the creation of an estimated 89,300 acres of land over the 50-year project life, most of which would be wetlands. The large volume of freshwater required to divert the sediment to build land would result in the conversion of thousands of acres of brackish and saline marsh in Breton Sound to fresh and intermediate marsh. This freshening would have a drastic impact on the estuarine-dependent marine fisheries of the Breton Sound Basin. The losses to these marine fisheries would greatly exceed the value of the commercial fish and wildlife and recreation that would accrue to the wetlands created.

The estimated first cost of the plan for diverting flow and sediment at Bhoemia without locks is $102,000,000 and average annual operation and maintenance cost is $15,600,000, which includes $11,100,000 for the increased maintenance dredging in the Mississippi River downstream of the diversion channel. The average annual cost of implementing the plan is estimated at $26,700,000 and the average annual losses to commercial fisheries would average $5,200,000. Average annual benefits to commercial wildlife and recreation would average $1,500,000. The resultant benefit-cost ratio is 0.06. A benefit-cost ratio of 1.0 or greater is necessary to establish a Federal interest.

Conclusions of the study are that measures to effect major diversions of Mississippi River flow and sediment to shallow water area for the purpose of building land are not economically feasible and are therefore not in the Federal interest.

Q. Colonel, do you need any additional Congressional authority to look at increasing the flows to the Atchafalaya River?

A. We have authority to study the feasibility of alternative distributions of flows between the Mississippi and Atchafalaya Rivers under the Atchafalaya Basin (Water and Land) Resources, Louisiana, study. One of the authorizing resolutions for the study specifically directed a review of the operation of the Old River System. In a report completed in January 1982, we recommended that the distribution of flows not be changed. We expect to receive completion funds for the remaining portion of the study in Fiscal Year 1990. Further studies under this authority would require additional funding.

Senator Johnston: "Colonel, Ms. Van Sickle talked about the building of our barrier islands by pumping in sand to which she described cost estimates. In your view can this be done and are the cost estimates realistic?"

Colonel Gorski: "I can not confirm her cost estimate. I'd be happy to provide the ones that we have looked at in our barrier island study."

Feasibility studies were conducted to define costs and benefits associated with restoration of barrier islands and beaches in Plaquemines and Jefferson Parishes, Louisiana. The project would encompass the arc-shaped chain of barrier islands and barrier beaches that extend from Barataria Pass generally eastward to Grand Bayou Pass. Grand Terre Island, at the west terminus of the project area, is about 40 miles south of the City of New Orleans and lies just northeast of Grand Isle, Louisiana, across Barataria Pass. The study focused on defining and assessing the possible consequences of restoration and maintenance of the approximately 16.3 miles of barrier islands and barrier beaches of the project area to recent historic conditions. Basic plan descriptions and costs are given in the following paragraphs.

Plan Descriptions

Each of the alternatives developed is a combination hurricane protection, barrier island and barrier beach erosion abatement, and marsh loss reduction plan. The hurricane protection component of the plans would provide varying degrees of protection from all storms with recurrence intervals greater than about 10 years. This protection would be realized in terms of allowing reductions in the required heights of inland ring levee hurricane protection systems that provide protection against specific design storms. The barrier island restoration, barrier beach erosion abatement, and marsh loss reduction components of the plans would, to varying degrees, retard wave induced marsh losses and retreat of the gulf shore line in the Barataria Basin.

. Plan 1:

This plan consists of restoration of the barrier islands and barrier beaches between Barataria Pass at the west end of the project and Grand Bayou Pass on the east. The restoration would consist of the hydraulic placement of a sand-fill beach with 1-foot vertical to 30-foot horizontal beach face slope extending approximately 225 feet above the water line (mean tide level). The design template also includes a beach berm

with a 50-foot wide crest at elevation 5.5 feet NGVD1/, and a 1-foot vertical on 20-foot horizontal back slope to tie into existing ground level. Provision for periodic nourishment of the sand beach face and sand placement at the margins of tidal inlets where erosion trends are expected to be intensive is included as a plan feature.

An additional plan feature calls for provision of a trilateral stone and shell jetty to protect historic Fort Livingston, located on the western end of Grand Terre Island, from shore line retreat and damage. This jetty would be a total of about 2,000 feet long with one leg, about 550 feet long, oriented approximately parallel to the gulf shore. The second segment would form an approximate right angle with the gulf parallel portion of the jetty, be about 960 feet long, and extend bayward approximately parallel to Barataria Pass. The jetty's third leg would continue at an approximate 45 degree angle some 490 feet toward the Barataria Bay side of Grand Terre Island.

The jetty section would be founded on a filter fabric and shell bedding and have a varying base width depending on the elevation of the gulf bottom where located. Other design features include a 6-foot wide jetty crest at elevation 4.0 feet NGVD. The side slopes of the jetty would extend from the jetty crest at 2-foot vertical to 1-foot horizontal to a 30-foot wide berm on the gulf side and a 10-foot wide berm on the protected side of the jetty.

The total cost of this plan (over the 50-year project) is estimated as $64.1 million, or about $3.9 million per mile.

. Plan 2:

This plan includes all of the features of Plan 1. With Plan 2, a vegetated sand fill dune would be provided in addition to the sand fill beach section described above for Plan 1. The sand fill dune would have a 10-foot wide crown at an elevation of 11.5 feet NGVD. The dune back slope would be 1-foot vertical on 5-foot horizontal and tie into existing ground. Toward the Gulf, the dune would slope at 1-foot vertical on 5-foot horizontal from the dune crest to elevation 8.5 feet NGVD and would then continue at a slope of 1-foot vertical on 30 feet horizontal to form a continuous beach slope to the waterline.

The total cost of this plan (over the 50-year project) is estimated at $70.1 million, or about $4.3 million per mile.

1/ National Geodetic Vertical Datum.

. Plan 3:

This plan includes all of the features of Plan 1. Additionally, Plan 3, calls for back filling selected abandoned oil and gas exploration canals on the bay side of the barrier islands with unclassified dredged material (not necessarily sand). The back fill would be placed to an elevation of 4.0 feet NGVD and extended into the back bay to produce total minimum island widths of about 475 feet.

The total cost of this plan (over the 50-year project) is estimated as $75.2 million, or about $4.6 million per mile.

. Plan 4:

Plan 4 incorporates all of the features of Plans 1, 2, and 3, that is, beach nourishment, dune construction, and back filling of abandoned oil and gas exploration canals.

The total cost of this plan (over the 50-year project) is estimated as $82.1 million, or about $5.0 million per mile.

. Plan 5:

This plan consist of back filling abandoned oil and gas exploration canals on the bay side of the barrier islands with unclassified dredged material (not necessarily sand). The back fill would be deposited to elevation 4.0 feet NGVD and extended bayward to produce minimum island widths of 875 feet. A dredged material berm with a 10-foot wide crown at elevation 5.5 feet NGVD and 1-foot vertical on 5-foot horizontal side slopes would be constructed approximately 250 feet bayward of the gulf shore line. No provisions for dune construction or beach restoration and periodic nourishment are included in this plan. Instead, approximately 900 feet of gulf shore line erosion and retreat would be allowed. Minimum barrier island widths would be maintained with periodic nourishment of the bay side of the islands with unclassified dredged material.

The total cost of this plan (over the 50-year project) is estimated as $46.0 million, or about $2.8 million per mile.

TESTIMONY OF THE LOUISIANA FARM BUREAU FEDERATION

PRESENTED TO THE COMMITTEE ON ENERGY AND NATURAL RESOURCES

UNITED STATES SENATE

REGARDING S. 229, AMENDMENT TO THE OUTER

CONTINENTAL SHELF LANDS ACT

SUBMITTED BY

RONALD ANDERSON, PRESIDENT

THE LOUISIANA FARM BUREAU FEDERATION

AUGUST 31, 1989

BATON ROUGE, LOUISIANA

Senator Johnston, my name is Ronald Anderson, and I serve as President of the Louisiana Farm Bureau Federation (LFBF). I am a dairy, beef cattle, soybean and feed grains producer from Ethel, Louisiana. Thank you for the opportunity to present to the committee the views of the Louisiana Farm Bureau Federation as it pertains to S. 229, Amendment to the Outer Continental Shelf Lands Act.

I would like to begin my remarks by indicating that LFBF believes that something must be done to both minimize and to turn back the clock on future coastal wetlands losses in Louisiana. This is evident in the fact that Farm Bureau has had a long standing policy regarding coastal zone management which states that Farm Bureau work in cooperation with other groups to draft legislation acceptable to agriculture which addresses the coastal erosion problem.

Coastal land loss in Louisiana continues in catastrophic proportions. Current loss rates are estimated at 40-50 square miles

each year. If this trend continues, 1500 additional square miles of marsh will vanish by the year 2040. Wetland loss along the coast threatens valuable agricultural land which has been in production for decades. Many agricultural commodities are raised in the parishes which border the Gulf of Mexico. For several of these commodities, wetlands play a vital role in production. Rice, for example, is a native wetland crop species which is very dependent upon a permanent, adequate supply of fresh water for its production. Farm Bureau policy supports the development of a plan to control salt water intrusion from the Gulf of Mexico into streams used for irrigation in Louisiana.

Sugarcane is grown commercially in 17 parishes, many of which border the Gulf coast. Several southeastern parishes where the majority of the coastal erosion is being experienced, in particular, Lafourche, St. Mary, and Terrebonne, together account for more than one-fourth of the state's total production. Producer income from this one industry accounts for 83 percent of total cash receipts received from all crops raised in these parishes. Many small communities and businesses are dependent upon the continued prosperity of this industry.

Two years of devastating back-to-back freezes in the early eighties all but made the Louisiana citrus industry a thing of the past. Many producers have since replanted and expanded their orange and grapefruit groves in Lafourche and Plaquemines parishes in the hope of never experiencing a killer freeze for another hundred years. However, the further encroachment of salt water threatens the future well-being of not only this industry,

but all agricultural enterprises along the state's coastal region.

The Louisiana commercial marine fishing industry is the largest in the nation. Our wetlands serve as the incubator for 90 percent of the commercial fish that are landed in the Gulf of Mexico. Without wetland nursery grounds, gulf fisheries production would decline significantly from current levels of 36 percent of the national harvest. Louisiana leads the nation in commercial seafood production, accounting for 60 percent of the menhaden, 40 percent of the shrimp and 30 percent of the oysters harvested in the United States. As a result of this productivity, Louisiana has four of the top five ports in the nation in terms of volume of fish landed. The economic impact of commercial fishing in Louisiana is estimated at $2.3 billion, excluding menhaden. The economic impact of recreational fishing is $500 million. Many individuals and numerous businesses throughout the coastal region are solely dependent upon the viability of this industry. However, the commercial fishing industry has seen better days. Over the past several years, this widely divergent industry has experienced declines in production. Limitations on catches of various species of marine life have had to be imposed in order to prevent possibly endangering the populations. This decline in populations is not the result of negligence in harvesting as some people have advocated, but can be directly linked to the ever vanishing estuaries as the result of the dwindling coastline. As you are able to realize from these examples, agriculture has a lot at stake.

Louisiana wetlands provide wintering habitats for 66 percent of the migratory birds using the Mississippi Flyway, supporting a recreational hunting industry worth $58 million annually. Also, Louisiana has been the number one producer of raw furs in the United States for as long as records have been kept.

We support the maintenance of the private property rights of U.S. citizens to make whatever use of their property they want as long as it does not adversely affect the property rights of others. In any discussion about wetlands protection, it is helpful to remember that for much of our history, wetlands have been viewed as a problem to be eliminated rather than a resource to be protected.

It should be realized that regulatory programs alone will not halt wetlands alteration or deterioration. Instead, emphasis on increased economic incentives to landowners such as wetlands reserves, easements, and cost sharing for restoration should be considered. This approach should promote cooperation rather than confrontation. In addition, increased information and education to wetlands owners on the significance of wetlands will promote public awareness and understanding.

The wetlands found along our coastline are unique to Louisiana. Nowhere else in the United States will you find such an ecosystem. For this reason, we recommend that any definition or interpretation used in defining exactly what constitutes a wetland be broad in nature. Currently used definitions vary not only among and within federal agencies, but at all levels of government. It is unrealistic to think that it would be possible to achieve one single definition that will be applicable to cover

all regions of our nation. Much of the fertile agricultural crop land located in the coastal parishes would probably be classified as wetlands if the same interpretation used for designation of a wetland in the Midwest were applicable to Louisiana. USDA Soil Conservation Service figures indicate that over 50 percent of the land farmed in Lafourche, St. Mary, and Terrebonne parishes is at a mean sea level of five feet or below. For this reason, we recommend that a field manual be devised containing broad descriptions of what constitutes a wetland by taking into consideration each section of the country's individual characteristics.

We recommend that the local USDA Soil Conservation Service be empowered to make all wetland determinations. Also, Farm Bureau strongly supports the existing Section 404 exemptions for agriculture as contained in the Clean Water Act.

If the proposed law empowers a state agency to have the responsibility to develop and administer a plan to restore the coastal wetlands within the state, we recommend that the Louisiana Department of Natural Resources (DNR) be the designated state entity. This department already has in place the experience and expertise to carry out the mandates set forth in this legislation. We further recommend that an advisory council or working group made up of the various state entities, including a representative for agriculture be formed on the state level. The purpose of this advisory council will be to allow for input from the respective state entities into the development of the specifications to be incorporated into any proposal to restore the coastline.

Farm Bureau policy states that ten percent of future 8G revenues be used in the funding of a viable coastal restoration plan.

In closing, I believe that agricultural production in the coastal regions of our state can be maintained at current levels of production while not having any bearing or adverse effects on the past or future deteriorations of our coastal wetlands. As I alluded to earlier in my comments, agriculture only stands to lose if this problem is not swiftly and effectively addressed. Louisiana needs assistance as it strives to develop and implement a wetland preservation agenda. Without federal assistance, Louisiana's coastal wetlands which provide extensive national benefits will be lost forever.

I would like to commend Senator Johnston for his insight into realizing the magnitude of the problem and for his initiative to address the situation through authorship of this piece of legislation. Farm Bureau stands ready to work with you and other interested parties in addressing and resolving this matter.

Thank you for the opportunity to express these views. We look forward to working with you in the future on this issue.

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1989 SEP 18 PM 11:57

September 12, 1989

Hon. J. Bennett Johnston, Senator
United States Congress
136 Hart Building
Washington, DC 20510

Dear Sen. Johnston:

Enclosed is my statement relative to the public hearing you held in Baton Rouge, La. on August 31 concerning Amendment 229 of S. 406.

I am truly sorry that previous commitments, along with the lack of advance knowledge of your meeting, prohibited me from making my thoughts known at the hearing. I do, however, sincerely appreciate this opportunity to enter them in the official record of the meeting.

With kindest personal regards, I remain,

Sincerely yours,

T. BAKER SMITH & SON, INC.

Wm. Clifford Smith, P.E.
President

WCS/pdb

Enc.

STATEMENT BY WM. CLIFFORD SMITH, P.E., OF HOUMA, LA., TO BE INCLUDED IN THE RECORD OF A PUBLIC HEARING HELD IN BATON ROUGE, LOUISIANA, ON AUGUST 31, 1989, BY SENATOR J. BENNET JOHNSTON ON HIS AMENDMENT NO. 229 TO S. 406 WHICH PROVIDES FOR THE ESTABLISHMENT OF A TRUST FUND FOR WETLANDS PROTECTION, RESTORATION, AND ENHANCEMENT.

I am a lifelong resident of Terrebonne Parish, Louisiana, as was my father before me. My father was a Civil Engineer and Land Surveyor and began practicing those professions here in Terrebonne Parish in 1913. I joined my father in the firm (T. Baker Smith & Son, Inc.) in 1957. Upon his death in 1962, I became President of the corporation and hold that position today.

Being a Civil Engineer and Land Surveyor and having begun my experiences in our coastal marshes and swamps at an early age, I believe qualifies me as an authority on what has and is taking place at an alarming rate.

To repeat the known causes and rates of subsidence and coastal land loss that have been so adequately documented does not seem to me to be necessary in this statement. It seems to me that every document presented at every meeting spends a great deal of time reiterating these proven facts.

For more years now that I care to count, I have been attending meetings, public hearings, seminars, etc. relative to coastal problems of the United States. Starting back in 1973-74, Louisiana began getting involved in Coastal Zone Management. The proposed legislation at that time assured that if an Office of Coastal Zone Management was organized at the state level, it would replace the Corps of Engineers permit authority in the coastal zone. Needless to say, this has not happened and, in my humble opinion, never will happen under the existing legislation. Instead, we are burdened with another level of bureaucracy requiring two permits instead of one.

We know only too well the causes of our problems with coastal land losses. These causes and their known effects have been studied over and over by every conceivable agency and they all confirm one another. What is needed is action. A plan, large or small it does not matter, something must be done and soon.

Many (or I might say most) of those performing studies, reviewing permits, and dictating to us what we can and can't do have little or no real knowledge of our area. They know only what they read which, in all probability, was written by someone with as little knowledge and based on laboratory experiments and/or results. Also, I doubt seriously that these reviewers own any property in wetlands.

Our problem is not what's happening to our barrier islands, coastal marshes, and fresh and intermediate swamps. Our problem is not necessarily what to do about it. We have some ideas and plans that we believe will work. Our problem is the bureaucracy: the myriad of reviewing agencies, all with single purpose objectives, and then the two level permitting system.

At this time and for the past three years, my firm (T. Baker Smith & Son, Inc.) is retained as the primary engineering consultant for the South Terrebonne Parish Tidewater Management and Conservation District. Through the efforts and leadership of State Senator Leonard J. Chabert, the District has embarked on what may be the most significant public works project that Terrebonne Parish has ever experienced. This project is known as State Project No. 750-55-02 - Chauvin and South Terrebonne Hurricane Protection System.

Thus far, we have completed the initial stages of approximately four miles of levee construction, and our first floodgate is nearing completion. All total, this construction constitutes the expenditure of some $6,000,000 with yet another $2,000,000 to $3,000,000 needed to complete this initial phase of the overall project. All of the funds for construction of this system came from appropriations out of the Capital Outlay Program (General Obligation Bonds) of the State of Louisiana, sponsored by State Senator Leonard J. Chabert.

Application for 404 permits for this work took quite some time, and now we are faced with having funds in the amount of $10,000,000 allocated and because of the 404 Program are unable to obtain permits in a timely manner to insure that we can take advantage of the allocation. Here again, we are stymied with the present permit system whose guidelines and procedures make it almost impossible to achieve an objective within a reasonable period of time. Some typical examples are as follows:

Falgout Canal Marsh Management Project:
Date Filed: May, 1985
Coastal Use Permit issued - Feb., 1988
COE Permit issued - Mar., 1989
(3 years, 10 months)

Bayou LaCache Structure:
Date Filed: Dec., 1985
Coastal Use Permit issued - June, 1987
Resubmitted to COE: Oct., 1988
COE Permit issued - May, 1989
(3 years, 5 months)

Bayou Terrebonne Levee:
Date Filed: Dec., 1985
Coastal Use Permit issued - June, 1987
COE Permit issued - Mar., 1988
(2 years, 3 months)

Bayou Caillou Floodgate:
Date Filed: Dec., 1985
Coastal Use Permit issued - June, 1987
COE Permit issued - June, 1987
(1 year, 6 months)

Also I might add here that because of the federal guidelines and procedures being used to compute the benefit/cost ratios, Terrebonne Parish is repeatedly receiving denials for federal participation. Because of this system, we must go it alone, and this we are doing. How long we can sustain the program with state funds alone is unknown, but surely with the economic conditions of the State of Louisiana, one can surely see that the program to protect Terrebonne Parish from Gulf storms without federal help will founder.

There was a time many years past when we feared flooding from the Mississippi and Atchafalaya Rivers. The cry for protection went out, and levees and protective structures were built. During that period, so called wetlands (swamps and marshes) were considered a nuisance and regarded by the federal government as vacant lands. The federal government divested itself of most of these lands (if not all of them) in Louisiana.

Now we are faced with inundation from the sea, and this will not be seasonal as was the riverine flooding which took place primarily in the Spring as the snow melted in the North. Now we are seeking help from this condition and find that the interest and concern for preservation of wetlands seems to outweigh the safety and well being of those who would pay for the protection with tax dollars. Pay with their property and possibly their lives for the sake of regulations and bureaucracy, promulgated by those with little or no real interest is what we are being asked to tell our people.

The theory that one set of guidelines and regulations can be applied nationwide is irresponsible. For instance, the 404 Program was written to control dredge and fill projects in the wetlands, and those wetlands were loosely defined as tidal areas. This definition led to interpretation by the courts and as a result, the 404 Program became all encompassing and subject to individual opinions of reviewers and permitting authorities trying to grope with the problem.

A complete overhaul of the permitting system is overdue and must be accomplished if coastal Louisiana is to survive. The Louisiana coastal area is one of the most unique areas of its kind and should be considered as such. As much as I feel repeating statistics is a waste of time, I do feel compelled to repeat this one:

> "Louisiana's coastal area represents 40% of the nation's wetlands and is experiencing 80% of the total national loss."

This I believe is the most important statistic of all. Of this state loss being experienced here in Louisiana, it is my sincere belief that the majority of that loss is occurring between the Bayou Lafourche Ridge and the Atchafalaya River, and that constitutes all of the Terrebonne Parish coastal area.

Certainly leveeing the rivers stopped annual overflow, and the floodways provide relief when needed to alleviate flood stages along the river. Everyone will agree that without these systems, development along the river, as we know it today, would not have been possible. The prosperity that we and the world have enjoyed from this training of the Mississippi River would certainly seem to justify these works.

Once this system of control was in place and continuously being improved to insure the protection of all forms of development, the area began to experience a transition to industrialization. Industry coinhabits the area with agriculture, aquaculture, commercial, and residential development.

For many years, coastal Louisiana, and Terrebonne Parish in particular, was on the verge of minerals exploration and production beyond one's imagination. The growing and expanding nation needed energy sources and minerals production to keep pace with post war demands. Louisiana's coastal marshes, swamps, and offshore waters became the place that much of the nation's energy supply would be coming from.

As long as the offshore (Gulf of Mexico) and inshore Louisiana areas were primary targets for exploration and production of those resources needed by the nation, it was full speed ahead. No one, federal or otherwise, promulgated regulations and created agencies to place rigid restrictions such as we have today. In those boom days, it took 30 days maximum to get a permit (a Section 10 permit) from the Corps of Engineers. For most of that time, there was no Coastal Zone Management Program in Louisiana.

Now the reserves are mostly depleted and the big oil companies are gone. The price of imported petroleum makes it uneconomical for those remaining in our area to explore the remaining mineral deposits. They came, and we welcomed them. Our resources helped to keep much of the nation warm in the cold winter months and cool in the summer. These resources also provided the refineries with an abundance of products to keep the world of transportation in a good supply of fuel as well as many other industrial and domestic products.

We had little choice but to base our economy on the oil industry. After all, prior to that Terrebonne Parish was an agricultural community with a very productive fishing industry. Oil was good to us, but now we are left with the residue and devastation of our wetlands. Subsidence, erosion, useless canals by the hundreds, toxic waste, and whatever else we inherited when our area was, for all practical purposes, abandoned and left to deteriorate even further.

I am indeed encouraged by your efforts in proposing Amendment 229 to S. 406. Funds, and more so an adequate source of funds, are what is needed most if the coastal marshes of Louisiana are to be protected from further deterioration and inundation by the relentless onslaught of the sea.

Without a source of funding to rely on, there really is no need for a plan. Yet on the other hand, you generally need some form of plan to ascertain the monetary needs of a program. Of course, this holds true for projects of a much lesser magnitude.

To say that Louisiana's coastal problems are so irreversible or unsolvable is an attitude that has led some to consider applying a system of triage. I do not subscribe to this defeatist attitude, and I seriously doubt that anyone in Terrebonne Parish will. Suppose that attitude would have prevailed when the inhabitants and landowners along the river experienced annual flooding.

We in Terrebonne are delighted that we are finally hearing high level officials in Washington, DC publically acknowledge and give credence to the reports and testimony pertaining to the deterioration of Louisiana's barrier islands, marshes, and swamps.

Too many times in the past, we have been told that costs involved in protecting what we have left would be monumental. My question is monumental compared to what?

Nothing like this has ever happened before. So how can you compare it and arbitrarily say the cost is too much!

We built the St. Lawrence Seaway, the magnificent dams, and vast reservoirs in the West. We also conceived and built the Interstate Highway System. I am sure that these and other projects had their detractors, but needs and demands of a nation prevailed.

Hopefully through education of the general public and your colleagues in the Congress, support for our problems can become a reality.

Unfortunately, the Louisiana coastline is not readily accessible to the motoring public as is that of the other states along the Gulf of Mexico and the east and west coasts. Actually, you get to our coast by road at only two locations. Grand Isle is one, and the other is Cameron.

Educating the nation through dissemination of information is vitally important for support of a program of coastal wetlands protection, restoration, and enhancement. Bringing those authorities who may not be sympathetic to Louisiana's problems to see for themselves, we believe, is vitally necessary if we are to gain their support.

We in Terrebonne Parish are in support of the proposed Senate Amendment No. 229 which will appropriate approximately $85 million to $100 million annually for wetlands protection, restoration, and enhancement.

Terrebonne Parish has approximately 1,069,500 acres of wetlands and an additional 274,500 acres of non-wetlands. As noted above, Terrebonne Parish as a unit contains over 74% wetlands and has a population of approximately 100,000 people who live within this predominantly wetland environment.

If Louisiana is losing anywhere from 30 square miles to 50 square miles of wetlands a year, we think our area should be of particular interest since we are losing to coastal erosion approximately 20% to 30% of our geographic area.

It is apparent that we have a multitude of problems in Terrebonne Parish. We believe that diverting freshwater and sediment from the western part of our parish through the Atchafalaya in a controlled way across the southern part of our parish will help to rebuild our marshes as naturally as possible and at the same time stop saltwater intrusion and reduce subsidence. In addition, we believe the barrier islands, our first line of defense, should be physically protected to reduce the direct impact of the Gulf.

I assure you and Sen. John Breaux that you have my full support and cooperation in pursuing the passage of Amendment 229.

Please accept my sincere appreciation for providing this opportunity to submit this statement in support of your effort to begin a program of funding for the preservation of the coastal wetlands of Louisiana. Louisiana's plight is and should be acknowledged as one of national concern and paramount to those directly involved.

September 11, 1989

Wm. Clifford Smith, P.E.
President
T. BAKER SMITH & SON, INC.

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